RADIO AND HOBBIES IN AUSTRALIA

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RADIO AND HOBBIES IN AUSTRALIA

GOOD NEWS FOR AMATEURS

MANY of our readers may have been interested to note a recent statement in the Press to the effect that an emergency radio network, utilising the services of licensed amateurs, was to be established in Sydney and other cities in New South Wales "for ARP and army purposes."

This preliminary announcement was mainly the outcome of a lot of hard work on the part of the Wireless Institute of Australia. Again and again this particular body has emphasised to the authorities the potential value of amateurs and their idle gear in times of emergency, when normal means of communication may be disrupted or, at least, heavily overloaded.

To cut a long story short, the present proposition is to use licensed amateurs to provide an auxiliary communication service for the NSW State War Effort Co-ordination Committee. Selected amateurs will man fixed and mobile stations. Their particular job will be to provide communication between headquarters, fixed posts and cars on the move—communication less vulnerable and more versatile than that possible by telephone or messenger.

As yet, the finer details of the scheme have to work themselves out. May we, at this early stage, pass on a word in season.

Any arrangement along the lines mentioned must, on no account, be regarded as an "open sesame" to all, permitting official seals to be broken, and the setting up afresh of transmitting equipment. The whole scheme will necessarily be under very strict supervision, and only those amateurs who have duly applied and been accepted will be allowed to put a signal on the air—and when the signal does go on the air, it will be on strictly official business.

In these days, when so much is at stake, it is essential that amateurs recognise the necessity of abiding by the regulations governing the use of their gear, no matter how strong is the urge to recapture the thrill of bygone days. What might happen in the event of the scheme being abused has been clearly demonstrated of late in the United States.

There, as a result of representations of amateur bodies, selected amateur stations were allowed on the air for the purpose of providing a communication network for ARP services in various centres. Apparently, the regulations governing the operation of the equipment were not as rigid as they might have been, and it was not long before a few thoughtless hams were engaging in traditional "rag-chews."

Warnings were ignored, and the outcome was simply that the authorities summarily revoked all licences and left a band of disgruntled and discredited amateurs—thanks to a thoughtless few. As far as we can gather, amateur gear in US is still silent.

Australian amateurs should seize the opportunity, as it is presented to them, to create for themselves a reputation against the day when they will inevitably have to fight for their place in the ether.

W. M. Williams

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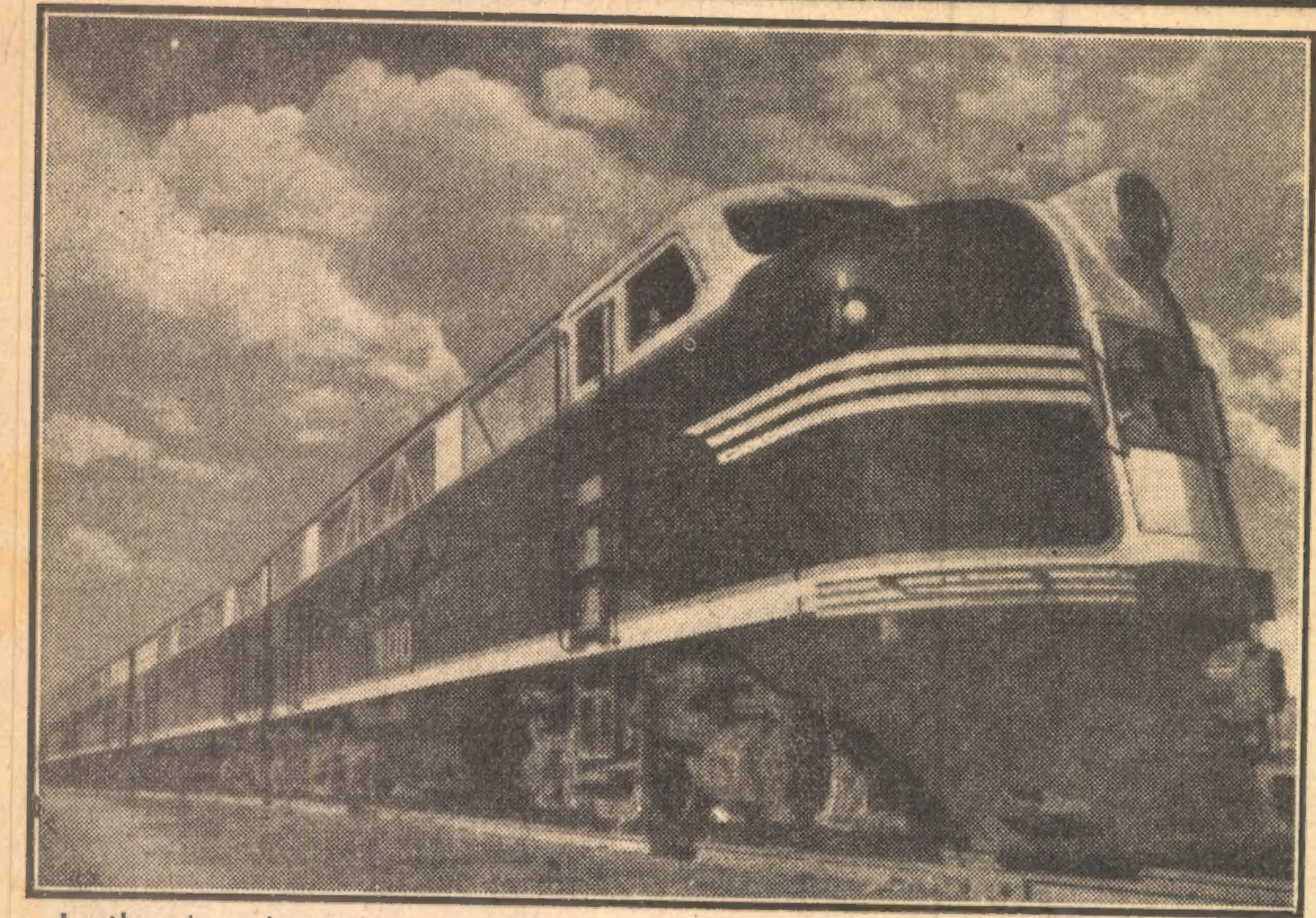
THEY CALL THEM "SMILING AUSSIES"

Yes, our Allies have often referred to the "smiling Aussies." But Goebbels bitterly complained of the men who "grin as they fight." When this picture was taken, Aircraftman Patrick was loading up an RAAF plane for bombing practice. Now the RAAF, with the Royal Navy and the AMF, is handling and facing the real stuff—but the old smile is still there.

A NEW ERA IN RAIL TRANSPORT—THE



In the American Army, a Jeep is a motor reduced to its essentials—and very reminiscent of the early model "T" Ford in appearance. It hauls anti-tank guns and other equipment over the roughest roads and stands up to the heaviest pounding any motor can take.

BUT on the West Coast of the United States and in the territory criss-crossed by the Santa Fe railway system, Jeep has a different meaning. There, it's the name of the newest thing in railway tractors, a 5400 hp Dieselectric train that uses only one cent's worth of fuel to haul 25 tons of freight a mile at top speed.

DIESELECTRIC POWER

If you'd like to ride the world's finest Dieselectric freight engine, just climb aboard! We're in the railyards of Kansas City, headed for Los Angeles with a drag of 66 carloads of heavy freight, on the first commercial run of the strongest thing on earth on wheels.

There are engines in England, as well as in America, of bigger horsepower rating than the Jeep, but they're made for swift passenger runs. The Jeep can start more freight cars moving than any other engine in existence; it can move more of them uphill than any other engine. And in these days of super transportation problems, freight cars are more important than passenger cars.

Look over the 193 feet of the Jeep's streamlined length, painted blue and yellow. Glance into the control-room, where the engineer wears polished shoes and sits in a swivel chair with padded armrests. Listen to the roar lift up and up as the 64 cylinders spin four generators, which turn 16 motors twirling 32 wheels. And watch the speedometer needle move up smoothly until it registers 76 miles an hour.

No. 100—the Jeep's official title—is more than a locomotive. It is the "beginning of the end" of steam traction

by L. B. Montague

on railways. There will be steam engines operating for years yet, but not many more will be built. The last steam switcher has come from the erecting shops. The big, high-speed, heavy-duty across-continent transportation job that is as much Australia's problem as America's will be taken over by a motor that is more efficient, cheaper to run, faster, four, or even three, any time such a schedule is set up. It can haul a heavy load faster, swing down the long mountain grades more swiftly, maintain better speed and cut time by eliminating stops. Hauling a train from Chicago to the West Coast by steam requires nine engines, which must make 35 stops for fuel and water. No. 100 goes right through with five brief fuel stops.

SPEED ESSENTIAL

Freight movement is comparatively slow, because freight trains spend a lot of time "in the hole" on sidings waiting for faster passenger trains to go by. Progressive railway managers have been working towards a so-called one-speed railway, over which everything moves at about the same schedule—and a fast schedule at that. This would eliminate a lot of delay, because freights would run as second sections to crack passenger trains, as some of the best merchandise drags already are running.

The fastest runs in the world today are being made by trains with Dieselectric power. The crack train run of the East Coast of the United States is between New York and Chicago, 950 miles covered in 16 hours. Diesel-powered trains cover from Chicago to Dewer, 1025 miles, in 16 hours—and lift the trains a mile in the air to boot. No one steam locomotive could do that, although five or six of them might.

It's the ambition of every boy, at one stage or another, to drive a steam locomotive. The vision always remains of the driver up there on his narrow seat, half frozen in winter, half roasted in

Rated at 5400 horsepower and nearly 200 feet long, this Jeep Dieselectric freight loco will outperform anything else on wheels when it comes to hauling heavy freight trains. It starts them moving smoothly, hauls them along at over 70 mph. Going downhill, there is no grinding of brake-shoes, no overheated wheels; the motors are made to act as generators, turning the mechanical into electric energy, which is then dissipated as heat over the roof of the locomotive.

★

and which will be, eventually, cheaper to build.

At one stroke, No. 100 can cut freight-hauling time from the heart of the Middle West, Chicago, to the Pacific Coast from six days to

"JEEP" DIESELECTRIC FREIGHT LOCO

summer. The white plumes of steam, the billowing of black smoke, the whistle and the bell, the flash and whirl of connecting roads—all these combined to make something heroic and romantic. That is, they do for the layman; for the railways engineering department they add up to a continuous headache.

On the other hand, the Dieselectric train looks like a steelbox sliding along—no steam plumes, no whirr of machinery, no chugging—and the air horn doesn't sound like the old chime whistle.

PERFORMANCE

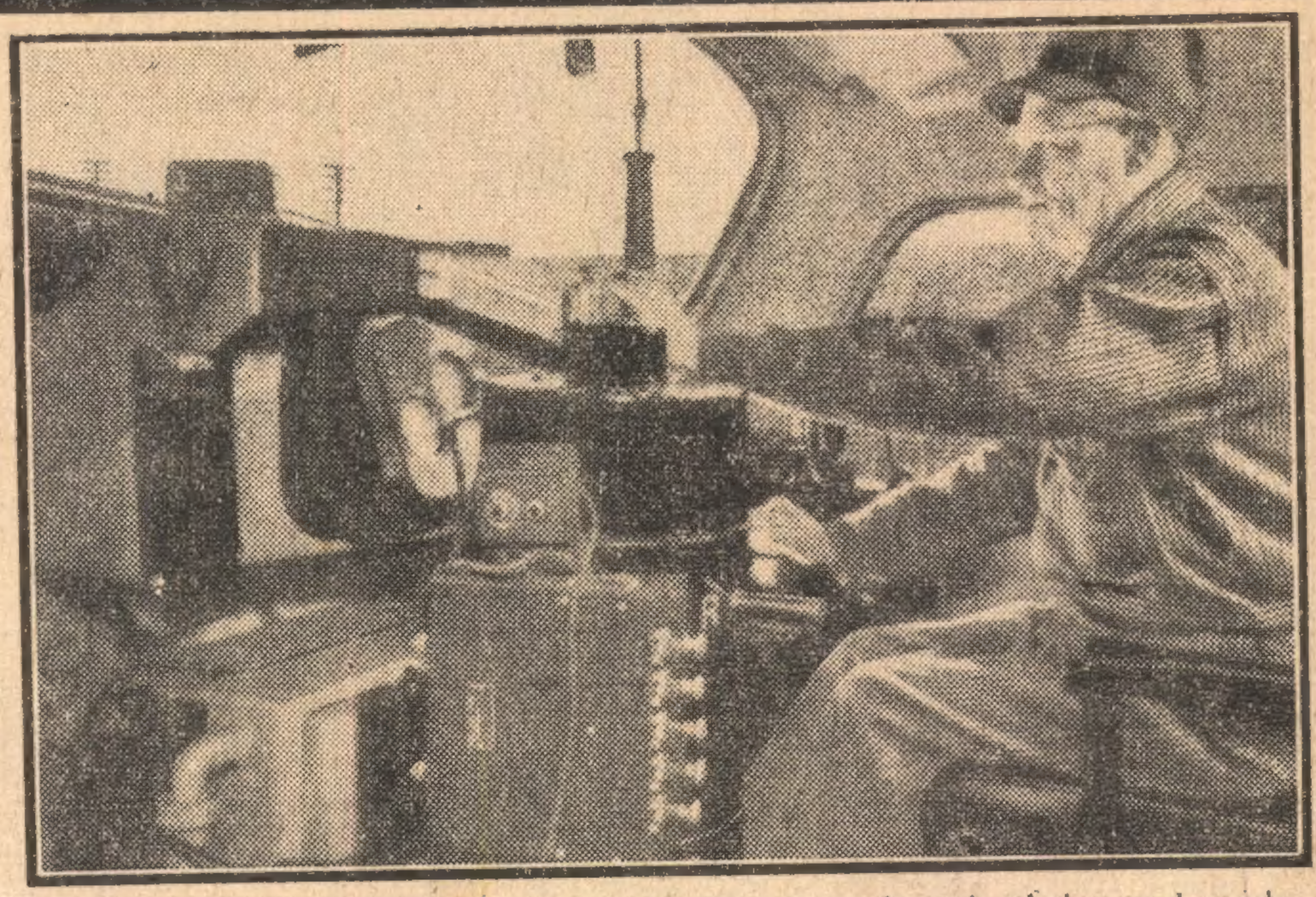
But if you put the old steamer up against a modern motor, it just can't compete. It is, at present, a little cheaper to build, but mass production methods will cut down that advantage. A locomotive like No. 100 will haul 5000 tons of freight in 100 cars 500 miles in 10 hours without a stop. It will move a ton a mile for one-twenty-fifth of a cent for fuel.

Another advantage the Dieselectric motor has, it will run continuously over long periods. If anything in a steam engine fails, the train stops. In a motor, if one section goes sour, the other three will haul the train while repairs are being made. A steam locomotive is available for duty only about one-third of the time, although on some of the new jobs an availability of 60 per cent. is claimed.

CONTROL CAB

A Dieselectric is ready for action 95 per cent. of the time. One of them hauled the "Capitol Limited" back and forth between Chicago and Washington for 367 days straight. Another sped between Los Angeles and Chicago, 2225 miles each way, for a solid year—and was late only twice because of engine trouble.

The driver sits comfortably in the control-room of the Jeep, looking out over her streamlined nose as the steel ribbons fly by. Ahead of him are broad, sloping safety glass windows like those of a motor car. The familiar wipers have a slot in them for spreading glycerine over the glass in winter weather.



The driver's cab of the Jeep is strangely different to the cab of the usual goods loco. Gone is the hissing steam, the grease, the grit and the belching smoke. Instead, the driver sits in an upholstered chair; before him is a maze of meters and polished handles. A large windscreen gives an uninterrupted view of the track ahead.

The engineer works from a softly-padded swivel chair, watching indicators and gauges. He doesn't make mistakes, but if he did, lights would flash and bells would ring. A needle on an illuminated dial tells him how to set his throttle; lamps warn him if his drive wheels slip, if he has a hotbox, if he is exceeding a predetermined speed. He must keep his foot on a "dead-man's" pedal or the train stops.

The cabin is heated by hot water radiators and is insulated against the roar of the motors. Around the streamlined prow of the cabin is a steel ridge. That's an "anti-climber," and it's there so that if the Jeep hits a cow or a horse at 75 miles an hour, nothing will fly up to break the windows and injure the crew.

All along the track, as No. 100 rolls by, the folks turn out to watch it and wave at it. At every stop the kids climb up and ask questions about cylinder bore and scavenger parts and torque, and how many miles to the gallon. Most of the people who ride streamliners call them "Diesel trains," but they are really electric trains carrying their own power plants, which are Diesel-driven.

TRANSITION STAGE

The present locomotives represent a transition stage; in the future, the power may be all Diesel, or it may be all electric, if some future Marconi invents a

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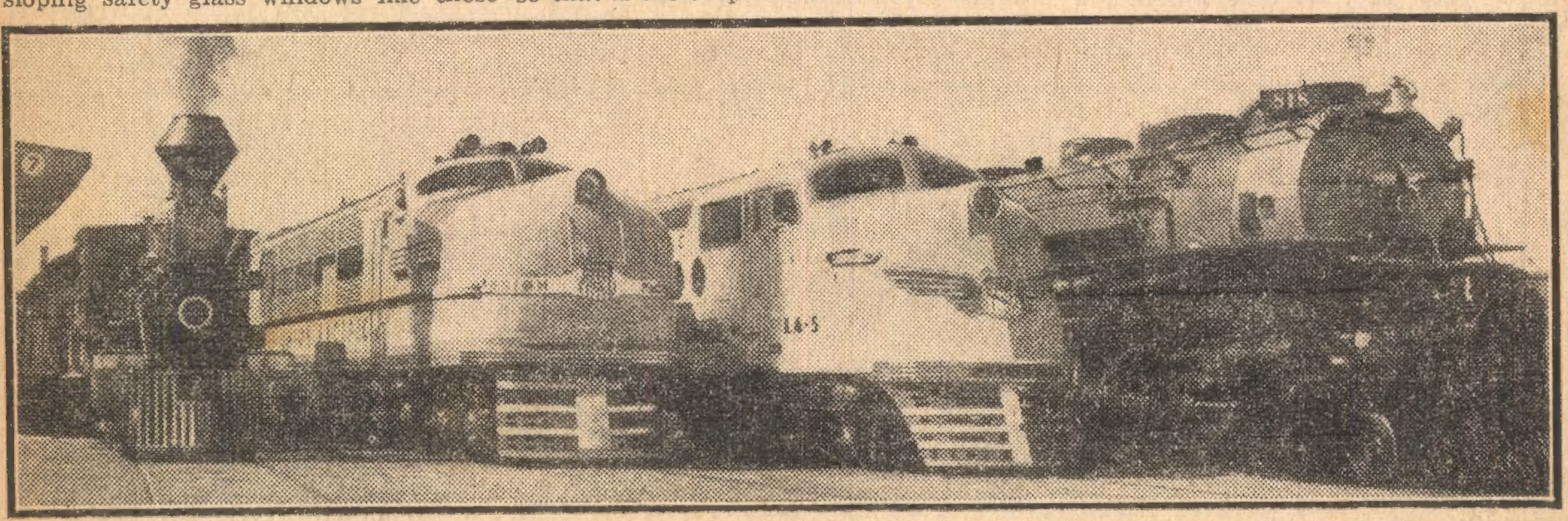
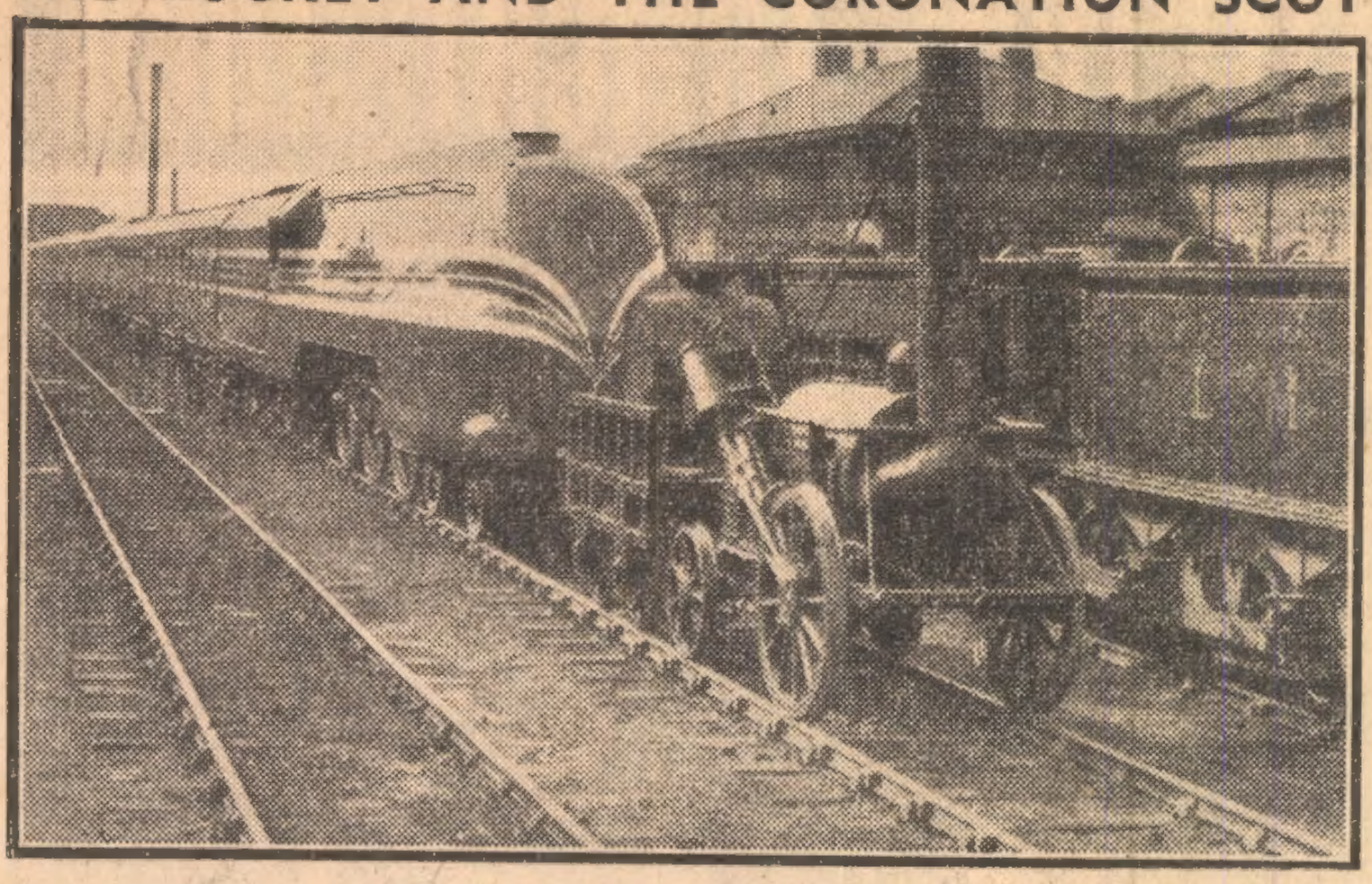


Nearly a century of railroad development is represented in these four locomotives of the Union Pacific railway. On the extreme left is an old wood-burner of the early sixties. Alongside it is a 5000 hp steam-electric loco 182 feet long and capable of drawing a twelve-coach train at 125 mph. The third is a 4000 hp. Diesel streamliner; on the right is one of the largest of the traditional steamers — the 3900 series Challenger.

FEATURE STORY

THE ROCKET AND THE CORONATION SCOT



In America particularly, and in other parts of the world, the trend is to higher and still higher operating speeds for the passenger and freight trains alike. Here we see England's Coronation Scot drawn up behind Stephenson's famous Rocket. It will be interesting, after the war, to note the reaction of British railways to Dieselectric or steam-electric locomotives.

method of picking broadcast power out of the air. The trolly-wire method of obtaining power, as used by our trams, is good where traffic is heavy, as on the suburban lines of our own capital cities.

But where long stretches of line come into play, the rolling power plant has definitely shown itself to be better.

You wonder, perhaps, why the engineers don't drive direct from the Diesels through a clutch, as in your car. They would if they could find a clutch that would work and stand up. The electric generators and motors are in there because they will start a train from a standstill, and a Diesel motor won't, any more than the petrol motor could start your car without using a clutch.

WORK OF FOUR MEN

The engineers don't like all the added expense, weight and complication of electric generators and motors, but they haven't yet found a way to eliminate them. Some day, someone will find a way to do it.

The Dieselectric revolution in freight-moving is the work of three men, backed up by a fourth. It started only 10 years ago, when Charles F. Kettering, production genius of General Motors, worked out a two-cycle Diesel in the General Motors Research Laboratories and in Kettering's yacht, the Olive K. The result was a new engine first exhibited at the Chicago Century of Progress Exposition in 1933.

It was small enough to fit into railway space limitations and powerful enough to haul a lot of cargo fast.

HAROLD L. HAMILTON

The new Dieselectric trains that followed were products of the work of practical railwaymen, electricians and automobile men. Harold L. Hamilton, now president of the General Motors subsidiary that builds most of the Diesel jobs, probably should be known as the Daddy of the Diesels. Hamilton was born on a ranch in Northern California, and at 20 years of age was firing on the Southern Pacific Railway. During the following years he learnt what it took to get trains over the track—and wondered if there wasn't a better way.

Later he became sales manager for White trucks, with the old idea of motorising the railways still gnawing away at him. Union Pacific and General Electric had played around with gas-electric rail cars, but never had gone very far. Some of the motor truck boys had tried flanging touch wheels to run on rails, but this hadn't worked well, either. Hamilton hired a part-time draughtsman out of his savings, and soon he had a gas-electric train of his own, on paper.

He took the plans and pounded New York pavements for nine months, raising £10,000 to build the car. It worked. He sold it and bought another. Thus Electro Motive was born in Cleveland, Ohio.

When Kettering developed his small Diesel, General Motors took over Hamilton's company. He resigned, but the pull of the new motor was too strong, and he was soon back running his old concern.

The engineering end of No. 100 comes from Dick Wilworth, who, like Hamilton, learned his profession the hard way. Dilworth was born in Seattle, son of a Puget Sound tugboat skipper, and he learned about gas engines in the Philippines, making them run on gin when gasoline prices were too high. He continued his experience by building power plants all over the United States and Mexico, worked for General Electric, and finally joined Hamilton in Electro Motive as his chief engineer.

MASS PRODUCTION

Hamilton and Dilworth between them built gas-electric rail cars from 1923 to 1930. When Kettering gave them the new Diesel, they just lifted out the gas engine and dropped in the new one.

Then General Motors sent in Frank H. Prescott from its Delco plant to apply mass production methods to the new motive power. An electrical engineer, Prescott is regarded in the automotive industry as a manufacturing wizard. At Electro Motive's plant at La Grange, near Chicago, the Prescott system brings in material at one end and rolls locomotives out at the other under their own power on an adaptation of an automobile production line. No. 100 represents only about 84 hours of work for the plant!

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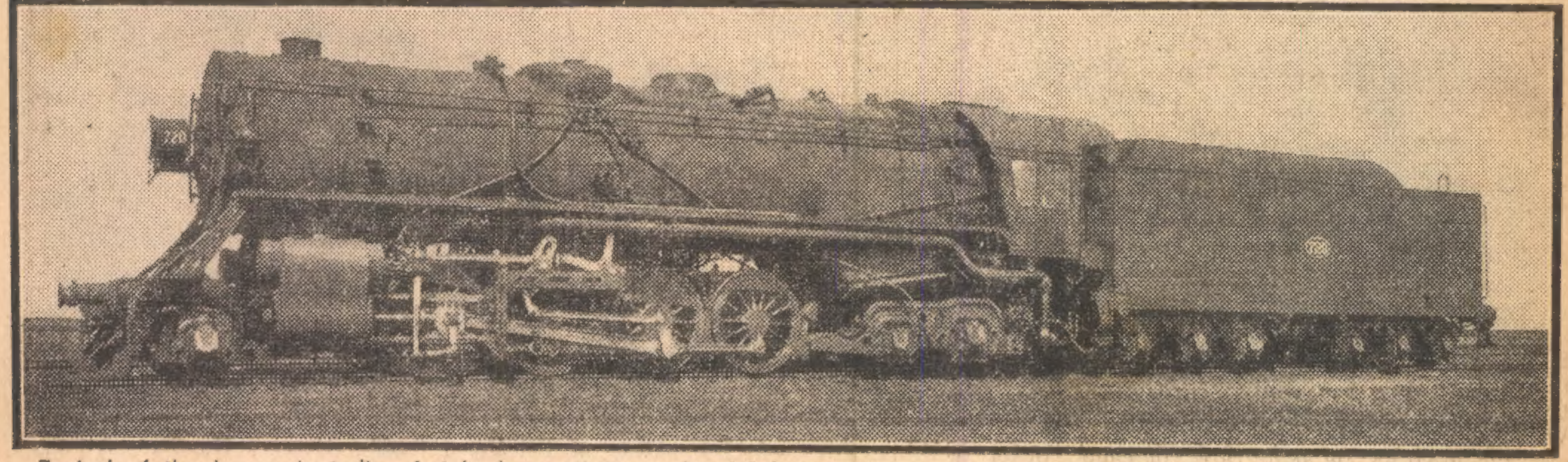
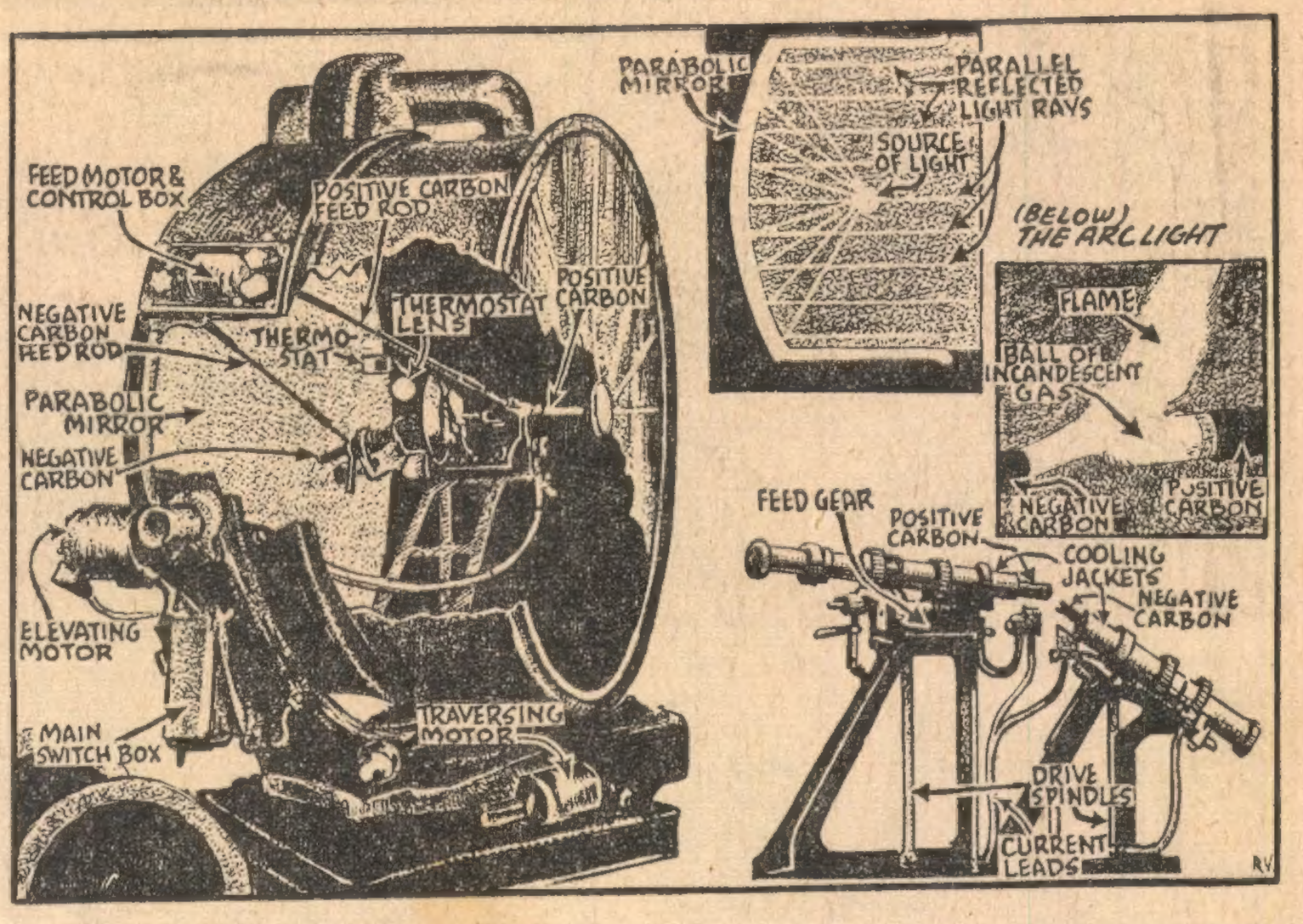


Typical of the larger Australian freight locomotives is this 2-8-4, 720 Class engine of the South Australian Government Railways. Over 83 feet long and weighing something like 233 tons, it has a horsepower rating of 1872. Of similar size is the 57 Class locomotive of the New South Wales Government Railways. The nominal power of the Jeep is nearly three times that of either of these engines, but the power is delivered to the wheels more smoothly and used to better advantage.

"HOW IT WORKS"—BY R. M. YOUNGER

THE SEARCHLIGHT

Just as weapons of offence have been made more potent, so have means of defence been improved. An outstanding example of this development of protective weapons and machinery is the searchlight, which is being used in all war theatres to pick up raiding planes.



THE most powerful searchlights whose use has been revealed have a light equal to more than 1,500,000,000 candlepower, and the beam thrown upwards is visible for over 100 miles. The concentration of light is equal to 300,000 candlepower to the square inch.

SOURCE OF LIGHT

Source of light is an arc flame. There is an electric circuit, of which two carbons, a negative and a positive, form part. When the current is turned on it passes from one carbon to the other over the gap between them, producing an intense electric spark. The spark makes volatile a small quantity of carbon between the rods, the resulting vapor forming a bridge across which the current is able to pass.

The vapor offers a high resistance to the passage of the current, however, and it becomes intensely heated, at the same time heating the carbon rods at their tips, causing them to glow brilliantly. The core of the carbon sticks is a rare earth such as thorium, lanthanum and cerium. The vapor given off becomes meandescent at 5430 deg. Fahrenheit.

The carbon tips are kept at the correct distance apart by a small electric motor which feeds the carbons as they burn back. To regulate the temperature, a spirit-cooling system with a copper jacket surrounds the carbons.

NATURE OF CURRENT

If d.c. is used, the positive carbon rod is consumed at about twice the rate of the negative rod, the end of the former becoming pointed—due to minute particles of carbon being torn off the positive rod and carried to the negative rod. When a.c. is used, however, both carbons are consumed at the same rate, for each rod alternately becomes the positive electrode.

Essential feature of the searchlight is the parabolic, silver-on-glass mirror, close to which the arc is situated. The shape of the mirror is shown in the upper right corner of the sketch. Production of the mirror involves difficult processes and is possible only after much careful optical work. The effect of the mirror is to magnify the light enormously by confining the light rays within a small area instead of allowing them to scatter. The principle of the whole searchlight is that light is reflected in a ray parallel to the axis of the instrument. There is only a slight amount of dispersion.

In some searchlights a combination of lenses was used to further concentrate the beam. The latest types, however, have plain glass fronts and are fitted with a special shutter arrangement that enables the light to be cut off instantly without the necessity of extinguishing the arc.

The entire movements of the searchlights may be controlled with a portable controller by an operator stationed some distance from the projector.

The arcs will burn for about two hours without trimming, and the newest types of searchlights can continue in use without the efficiency of the beam being seriously impaired even if the mirror is fractured.

HOW BIG IS AN ICEBERG?

HOW big is an iceberg? Very few people, probably, could answer that question, but that is just one of the curious pieces of knowledge that pilots of the RAF Coastal Command have to possess. Some of their flights take them far into the Arctic Circle, and they must send back reports on what is happening to the ice up there.

So that these reports may be strictly accurate, the pilots and navigators have learned the traditional ice terms current for centuries among the fishermen of the Far North. The answer to the question about the size of an iceberg is that it is "a mass of floating glacier ice rising more than 15ft. above sea level."

If it is lower than that, it is not an iceberg, but a "bergy bit." A bergy bit, the pilots are told, is usually about the size of a cottage. There are numerous other technical ice terms. "Brash," for instance, is broken ice in small fragments through which a ship can be forced. "Field ice" is a large area of unnavigable ice whose limits may not be visible from the masthead of a ship.

"Growlers" are detached pieces of icebergs or pack ice, almost awash. "Pancake ice" is newly frozen ice, in pieces 1½ft. to 10ft. in diameter and 2in. to 4in. thick, with slightly upturned edges.

The general term for all kinds of soft ice which cannot carry a man, or a seal, is "sludge ice," whereas "slush" is a thin layer of ice crystals covering the sea, so that the ripples disappear and it becomes greyish in color.

TRY IT SOMETIME!

A MAN with almost no clothes on and with plenty of water to drink can maintain a normal body temperature in perfectly dry air at a temperature as high as 250 degrees Fahrenheit. This temperature is above the boiling point of water and above the point where meat will cook.

THERE'S NO SUBSTITUTE FOR WATER

Water is the most common thing in the universe. It falls from the clouds as rain, it lies in puddles in our streets, it forms the rivers, lakes and oceans. More than two-thirds of the earth's surface is covered by water. Yet it is one of the most wonderful of all substances; without it, all life would perish. The machinery of nature is founded upon this versatile substance.

ASK any chemist what material is most essential to the science of chemistry and he will answer, water. Ask a teetotaller what he prefers to drink and he will say, water. Ask a "booze" artist what is most essential to him and he will say beer. But he would be wrong, for water is the base of his beer. It requires some ten gallons of water to make 1 gallon of beer.

When I say that water is the most common of all substances in nature, it does not follow that it is always the easiest to procure. To prove this, one must only mention the Sydney water supply. But it may not be prudent to pursue this any further, in case I have some Water Board officials among my readers.

Water constitutes about 70 per cent. of all living things. The human body is about seven-eighths water. When it comes to vegetables and fruits, the water content rises considerably. Potatoes, for instance, are mostly water—just like the "tea" one gets nowadays in restaurants! I had some mashed potatoes the other day—mostly water!

When you eat a strawberry, you eat nine-tenths water. Or should I say you drink? Yet one can't drink a strawberry.

In nature, water is in a continual state of circulation. A good idea of the effect of this circulation can be gleaned from the following quotation:

"Evaporation from seas and lakes and from trees causes an accumulation of water vapor in the upper atmosphere, which eventually condenses to form clouds, consisting of very small drops of water; when these drops reach a certain size they fall as rain.

INDIRECT ACTION

"Much rain falls directly into the seas and oceans, but a great deal also falls on to land areas and either drains straight into a stream or else it soaks into the earth.

"The underground waters accumulate and soon break their way through as a spring and form a stream; this eventually joins a river on its way to the sea. In the course of this circulation, water helps in the disintegration of rocks, the formation of soil and the making of scenery. The action of water is both mechanical and chemical.

In the artistry of nature, water plays a very prominent part. How strange and barren the world would seem without the seas, the lakes, the rivers, the mighty waterfalls and the delicacy of mountain cascades.

"The fall of rain helps in the loosening of softer rocks, and as the water flows over the surface of the earth, it carries away with it particles of soil and stones. Frost is a very powerful agent for the disintegration of rocks; water gets into rock crevices and in cold weather it freezes.

"In freezing, water expands, thus causing the rock to crack and, when the ice melts, the pieces of stone fall away. This breaking-up process lays bare fresh portions of rock, so that any soluble material which it contains may be dissolved out by rain water."

SOIL EROSION

Thus it is that rivers and glaciers bring about soil erosion and cause valleys and ravines. The solid matter is carried down rivers and so into the sea. With it is carried the salts of the earth dissolved in the river water and, as enormous quantities are discharged into the sea every day, it follows that, since the salts cannot get away, the sea is getting more salty as time goes on.

The chemical composition of water is very simple. Just a combination of two gases, hydrogen and oxygen; there are two parts of hydrogen and one part of oxygen. Sounds simple, doesn't it?

But if all the water on the earth was suddenly "exploded" into its two constituent gases, we would all be squashed into the earth by the rise in the atmospheric pressure. This pressure,

by Calvin Walters

NATURE'S MOST WONDERFUL SUBSTANCE

now 15lb. to the square inch, would rise to 6000lb. to the square inch.

Water can be broken up into its two gases by the passage through it of an electric current. When one cubic inch of water is thus disintegrated it will give us 1244 cubic inches of hydrogen and 622 cubic inches of oxygen, or a volume 1866 times the original volume.

Now gas can be compressed, whereas water can be compressed very little. If it was desired to compress these two gases down to the equivalent space of the original water, it would require a pressure of 25,000lb. per square inch to do it.

But an electric spark flashed in the mixture of the two gases will accomplish instantly what the 25,000lb. per square inch could accomplish so laboriously. Flash this spark, and each atom of oxygen pulls to itself two atoms of hydrogen and condenses the 1866 volumes of gas into one volume of water.

THREE CHARACTERISTICS

There are three characteristics of water that chemical theory has not explained. These are its low vapor density, its high boiling point, and its expansion on freezing.

When other liquids boil at a temperature equal to the boiling point of water, namely, 212 degrees Fahrenheit, they give off a gas that is heavier than air.

But water has a low vapor density in that, when boiling, it gives off steam, which is lighter than air. It is fortunate that this is so, otherwise all of us would have to grope our way about through the layer of steam that would lurk along the ground like a fog. We could have no rain, for rain depends, as explained above, on the condensation of water vapor in the upper atmosphere.

If water behaved like other liquids, it really should boil at 212 degrees below zero, in order to evaporate into a gas that is lighter than air.

Almost every other liquid shrinks when it freezes. Water, on the other hand, contracts as it cools, but just before it solidifies into ice it begins to expand again.

WHY ICE FLOATS

This is very fortunate for, if this were not so and if water behaved like other liquids, all the ice that formed in rivers and oceans would sink to the bottom, trapping the fish and constituting a menace to shipping. Its one advantage would be that Herr Hitler's U-boats would have a bad time.

The ice would sink because its solid form would be denser than the liquid form. Ice floats because the density is less than the water of which it consists.

Water can store more heat in proportion to its weight than any other substance, except hydrogen. In other words it takes more heat to raise a given amount of water one degree in temperature than any other substance except hydrogen. This means that, when you fill your hot water bottle these cold nights, you get more heat than if you filled it with, say, milk beer or lemonade. It stays hotter longer.

Thanks to the expansion of water just above its freezing point, ice will float. If this were not so, ice formed on the surface of the water would sink. The cold depths of the sea would gradually become solid ice, with disastrous results for plant and fish life — and, perhaps, for Hitler's U-boats.

The peculiar characteristics of water, namely, low vapor density, high boiling point and expansion on freezing, are supposed to be due to the particular structure of the water molecule. The molecule is what scientists call "polar." That is, it has a head and a tail; one end, say, the head, being positively charged, and the other end, the tail, being negative.

A tail is a negative thing, so it is natural to refer to a head and a tail being positive and negative respectively. (This remark is more canine than scientific.—Ed.)

The seepage of water through limestone is responsible for the creation of stalagmites and stalactites. Australia's famous Jenolan Caves owe much of their beauty to this fact.

WATER ON OIL

Experiments have been carried out by Dr. Irving Langmuir with oil on water which illustrate polar structure.

No doubt some readers have noticed that most oils, if placed on water, spread out into a thin film with a beautiful show of iridescent colors.

But there are some oils that do not do this. Instead, these oils form droplets on the surface of the water and refuse to spread.

Dr. Langmuir has found that there are differences in the molecular structure between the "spreader" oils and the "non-spreader" oils.

The oils that spread have, at one end of the molecule, one atom of oxygen coupled with one atom of hydrogen. But the non-spreading oils do not have this group.

It is characteristic of all substances which possess this particular O-H group

(Continued on Next Page)

Fortunately, perhaps, the man pictured above is not a real chemist; the face behind the respirator belongs to George Wallace, the well-known actor. However, to the chemist, the most important single substance is water. Take away water and you take away the basis of most of his experiments.

that they either spread over the surface of water, thus attaching themselves in the form of a film, or they actually mix with the water by dissolving in it.

Thus, alcohol, for instance, has this O-H group, and, of course every consumer of this substance knows that water and alcohol will mix.

Sugar and other salts have the O-H group and these unite with water by solution. Petrol on the other hand has no O-H group and, therefore, does not mix with water—to the disgust of motorists who could do with such a mixture at the present time.

THE EXPLANATION

Now, to explain this peculiar behavior, it has been shown that any molecule which contains this O-H group is like a magnet with the O-H end as its negative pole.

It has also been proved that an atom of hydrogen behaves as a positive pole and negative attracts positive. This is a well-known law of electricity.

Water then consists of two atoms of hydrogen and one of oxygen and is usually depicted as H20. It can also be written like this, H-OH. Thus, we have an apparent magnet with a positive "H" at one end and a negative "OH" at the other end.

What happens now when we drop a quantity of a "spreader" oil on to the surface of water? The negative OH of the oil will attract a positive H of the water molecule until the oil has united with the surface molecules of the water. The film will ultimately be one molecule thick.

SUGAR IN SOLUTION

Similarly, sugar and other salts will act in the same way, the negative OH of the sugar uniting with the positive H of the water.

Water itself is held together by the acinity which each molecule has for its fellow. The OH end of the molecule attracts and holds fast the H end of its fellow molecule. Like this: H—OHH—OHH—OH. This probably explains the high surface tension of water. Water actually prefers water and it is only by exciting its particles to high speeds that they can be enticed apart. Then they break through and escape as steam.

The reason why a non-spreader oil will not unite with water is as follows: The non-spreader oil may contain only a positive or negative article. As negative will only be attracted by positive, it follows that, if the oil is negative, it will only attach itself to the positive particle of the water molecule, thus forming a globule on the surface of the water.

If, on the other hand, the oil is positive, it will only attach itself to the negative part of the water molecule and will form a globule on the water in the same way.

There are other waters than cold water, hot water, salt water, fresh water, dirty water, tap water and rain water, &c. There is what the scientists call "heavy" water.

A few years back, some scientist chappie found out that all hydrogen and oxygen atoms do not weigh the same. These scientists are always behaving like that. No sooner do they settle a question and get nicely fixed in their armchairs again than up comes some super inquisitive fellow who throws a spanner into the works and makes them get up and start all over again.

That is presumably why professors have long hair and grow long beards. They haven't even time to shave or go to the barber.

HEAVY WATER

That is what happened about this oxygen and hydrogen. Instead of hydrogen weighing 1 and oxygen weighing 16, this bore of a fellow found that some hydrogen atoms weighed 2 and some 3. Also, that some oxygen weighed 17 and some 18. It is thus possible to have some twenty-seven different kinds of water.

The heaviest water would be a combination of hydrogen weighing 3 and oxygen weighing 18, giving a total weight of water of 24—two hydrogen at 3 each and one oxygen at 18.

All common water is a total weight of 18 units, since most of the world's oxygen and hydrogen supply are of the usual weight of 16 and 1 respectively.

Heavy water has been produced and it is calculated that, when you turn the tap on, every 7000 gallons of water you draw off contains about one gallon of heavy water.

RETARDS REACTIONS

An Edinburgh professor, J. E. Kendall, maintains that chemical reactions take place more slowly in heavy water, and he further maintains that, if this heavy water was used exclusively for drinking purposes, the chemical changes in the body would take place only about half as fast as usual, and a person would live twice as long.

He does not explain why a person wants to live twice as long as usual, but, no doubt, being a Scotsman, he assumes one would save twice as much in a lifetime.

In any case, I can see disadvantages in the possible pumping of heavy water through the mains. For one thing, as soon as the supply people became aware of its special qualities, they would bump the price up. Then again if one wanted to produce some watermelons or cucumbers, look at the extra work entailed carrying water in a can. Water is heavy enough as it is under those conditions.

WATER AND LIMESTONE

Water, as I mentioned previously, plays a very important part, directly and indirectly, in the formation of scenery. An instance are the stalactites found in caves. Pure water will not dissolve chalk or limestone. However, on its way down from the clouds, the rain water dissolves a certain amount of carbon dioxide, which is always present in the atmosphere.

This enables the water to dissolve lime and the resulting solution is calcium carbonate. Stalactites are found in caves in limestone country and are formed by water seeping through the upper ceiling of limestone and dissolving the calcium. The re-

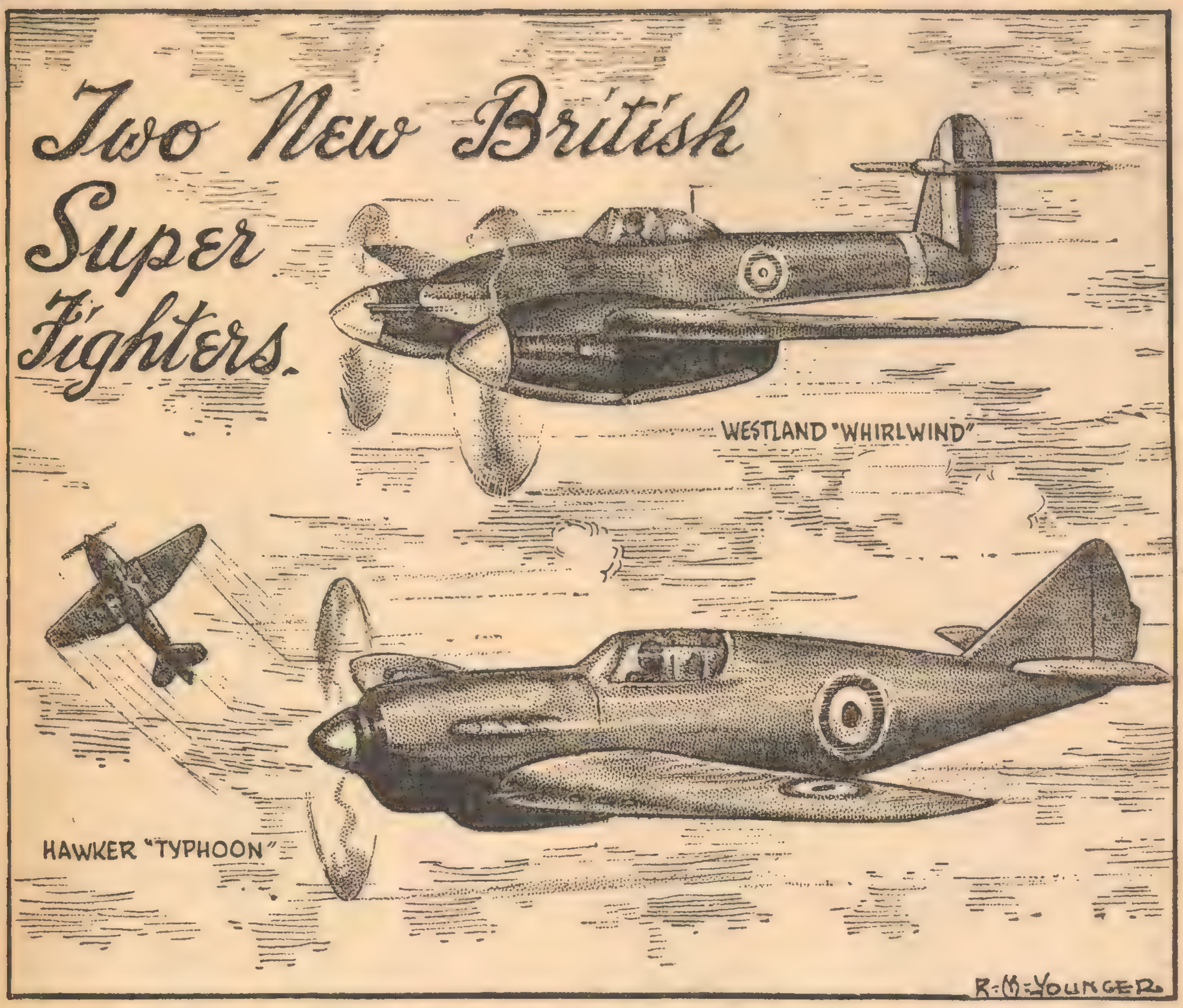
(Continued on Page 15)

ARE YOU A SUBSCRIBER?

THE last two or three issues of "Radio and Hobbies" have been sold out completely within about 10 days of being released. We have received many letters from readers who have missed out on their copies and who are anxious to complete their files. Unless a few odd copies happen to be returned to us we can do nothing to help, since we simply cannot increase the number printed each month.

The only way to ensure receipt of each issue is to place a definite order or a subscription with your local newsagent. Alternatively, you may send your subscription direct to this office, at 60-70 Elizabeth-street, Sydney. Annual subscription is 6s posted, or 3s for a period of six months.

AIRCRAFT OF TODAY — BY R. M. YOUNGER



Successfully meeting the challenge of Germany's latest aircraft are these new British fighters. They are 350-mile-an-hour-and-over "flying bullets" of specialised design.

THE Westland Whirlwind, at the top of the sketch, is a twin-engined, low-winged monoplane, with the engines set low. The motors are Rolls-Royce "Peregrines" of about 850 horse-power each. The plane is a long-range fighter.

Span of the Whirlwind is 45 feet and length 32 feet. It is a single-seat plane, and, like other Westland products, it has efficiency as the keynote of its unusual design. A peculiar feature is the setting of the elevators high on the tail unit.

Fire-power has not been forgotten. In the nose are four 20mm. cannon.

The other plane sketched—the Hawker Typhoon—is a fighter designed to operate at exceptionally great altitudes.

At the outset of the war air fighting was seldom over 20,000 feet; now the ceiling for fighters—both British and Nazi—has been pushed up to a height approaching 40,000 feet. The need for a plane such as the Typhoon has become urgent—but British designers had foreseen it.

The "flying-bullet" Typhoon, single-engined, is really a development of the tried and trusty Hurricane. It is the work of the same designer—Mr. Sydney Camm—and is produced by the same Hawker firm.

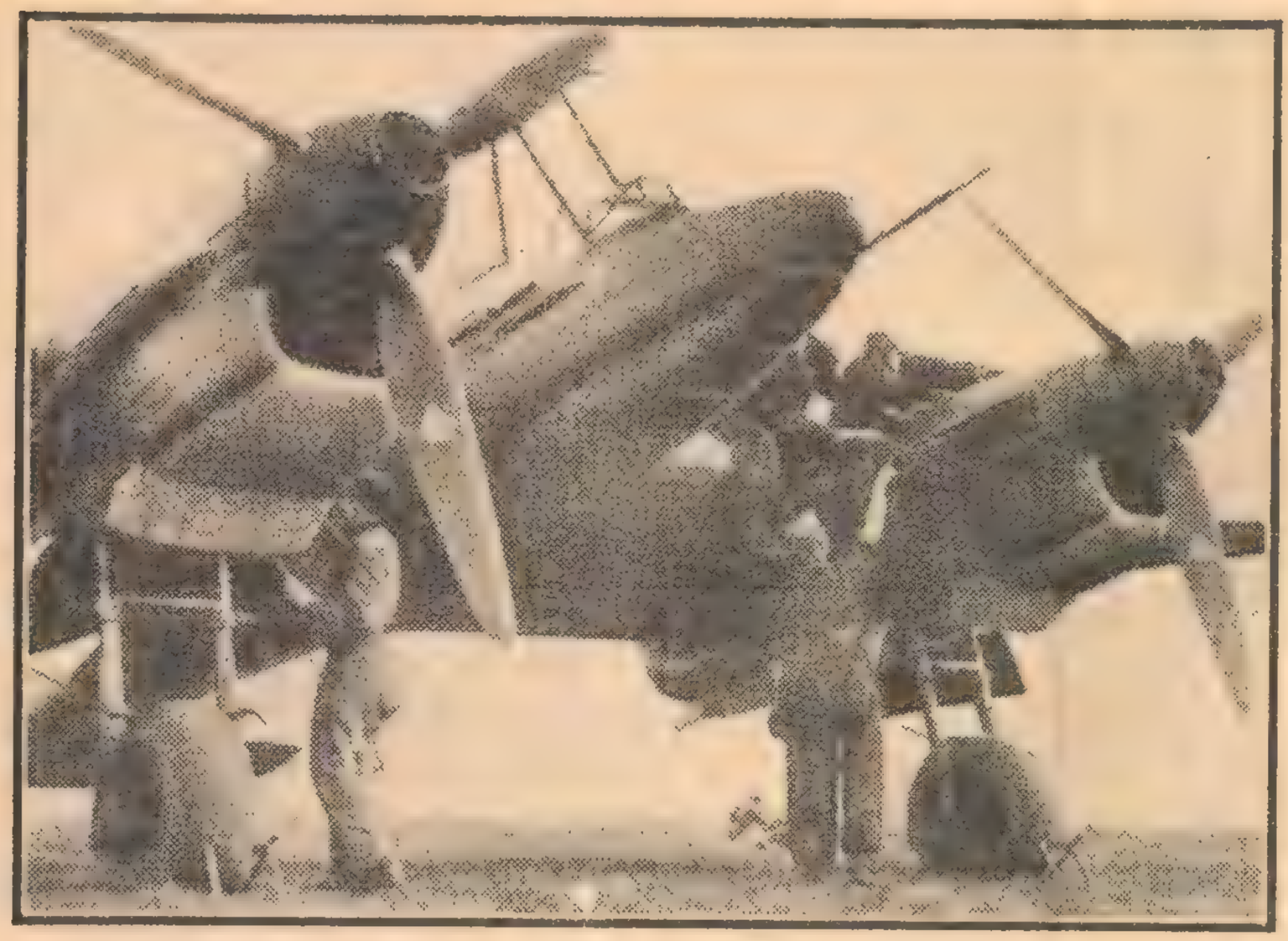
It is a low-wing monoplane of orthodox "fighter" design, smaller than the Whirlwind. But it has an immensely powerful Rolls-Royce motor, said to develop 2400 horse-power on the ground. The engine uses fuel at a tremendous rate, so that the Typhoon has a very limited range.

It is believed, however, that its great engine power gives the plane a speed of 425 mph. This, combined with its heavy armament (probably three 20mm. cannon and six machine-guns), makes the Typhoon probably the world's best short-range fighter.

These two fighters—the one a long-range attacker and the other a short-range intercepter—can outstrip and outmanoeuvre any enemy planes.

One commentator expressed the situation they create when he said that, with such outstanding planes in service with the RAF, it looked like "good business" for the German parachute packers!

THE FOCKE-WULF FW187 "ZERSTORER"



A front view of the German Focke-Wulfe FW 187 fighter-bomber. Note the very slender fuselage and the long observation window beneath the nose of the plane. It is just possible to make out the recesses in the fuselage for the machine guns, and the recess for the cannon just near the wing root. Note also the very large propeller spinners, which are referred to in the text.

Probably because the attention of the RAF Bomber Command has been concentrated on the extensive Focke-Wulf aircraft factories at Bremen and Johannestal, one of the firm's newest planes, the FW187, in the class known as "Zerstorer" (pronounced "Zairshterer" and meaning "destroyer"), has not appeared in active service numbers until fairly recently.

IT was first mentioned as early as the end of 1939, when little was known about it, except that it was a twin-engined machine, which could be used either as a fighter or fighter-bomber. Later, one Staffel of the Luftwaffe was equipped with these machines, and some were seen operating over Occupied France.

Not many ventured over the English Channel, and, consequently, information was hard to obtain, as none had been shot down and captured. However, large numbers of these machines have been used over Russia, and many have been shot down there

Like ourselves, Germany has realised that fast twin-engined fighters are becoming a necessity. These fighters have a long range and so can escort bombers for the full distance of their flight, protecting them from enemy air attack. Also, these long-range fighters can fly to points on another front at a moment's notice, if things look black there.

They can carry heavier armament than can the single-engined, single-seat fighter, and are, therefore, more useful to an attacking force. They make excellent "tank-busters," and can cause a great deal of damage to enemy installations in ground-level attacks.

Typical examples of British aircraft in service of the above category are the "Beaufighter" (described in Christmas, 1941, issue of R. and H.) and the "Whirlwind" (described in the August, 1942, issue of R. and H.), both of which are equipped with four cannons; the Beaufighter has six machine-guns as well.

by John French

The FW 187 was Germany's answer to these craft. Early in 1941 the Germans released to neutral countries photographs of the FW 187, although no figures as to size, speed, &c., were released.

It was realised immediately that the machine was in the same category as the Messerschmitt ME 110, which has been in service since the war began and of which considerable numbers have been shot down over England.

This later machine, slightly redesigned, has been used as a light bomber and has made many single "hit and run" raids on London and coastal towns in England. The FW 187 has not replaced the ME 110, and is possibly not intended to replace it. More likely, it is intended to supplement it and to increase the number of long-range twin-engined German fighters.

DESIGN DETAILS

The FW 187 Zerstorer is manufactured by the Focke-Wulf concern and is an all-metal monoplane of rather outstanding design, with two in-line motors, a low tapered wing, and a single fin and rudder.

It has practically remained unaltered since the prototype appeared, which is surprising for any aircraft because many modifications usually have to be made before a prototype goes into service.

Typical of Focke-Wulf designs, it has a long, slim fuselage and a broad, high rudder. A slight break in the trailing edges of the outer section of the wing is also characteristic of Focke-Wulf designs. The fuselage is of monocoque construction and is bolted together, being manufactured in four separate sections.

This is the general policy adopted today by the Allies as well as the enemy, for, should one section be badly damaged in combat or on the ground, it is easily replaced by a new part, straight from the factory.

Thus, a machine which might have remained, on old standards, out of service for weeks, is in flying nick again in a short space of time. The fuselage cross-section of the FW 187 is oval throughout.

WINGS, TAIL UNIT

The very thin wing is also manufactured in four parts. The centre section, bearing the motors, has a slight negative dihedral angle and is constructed of four spars with metal covering. The outer wing sections are detachable and have only three spars.

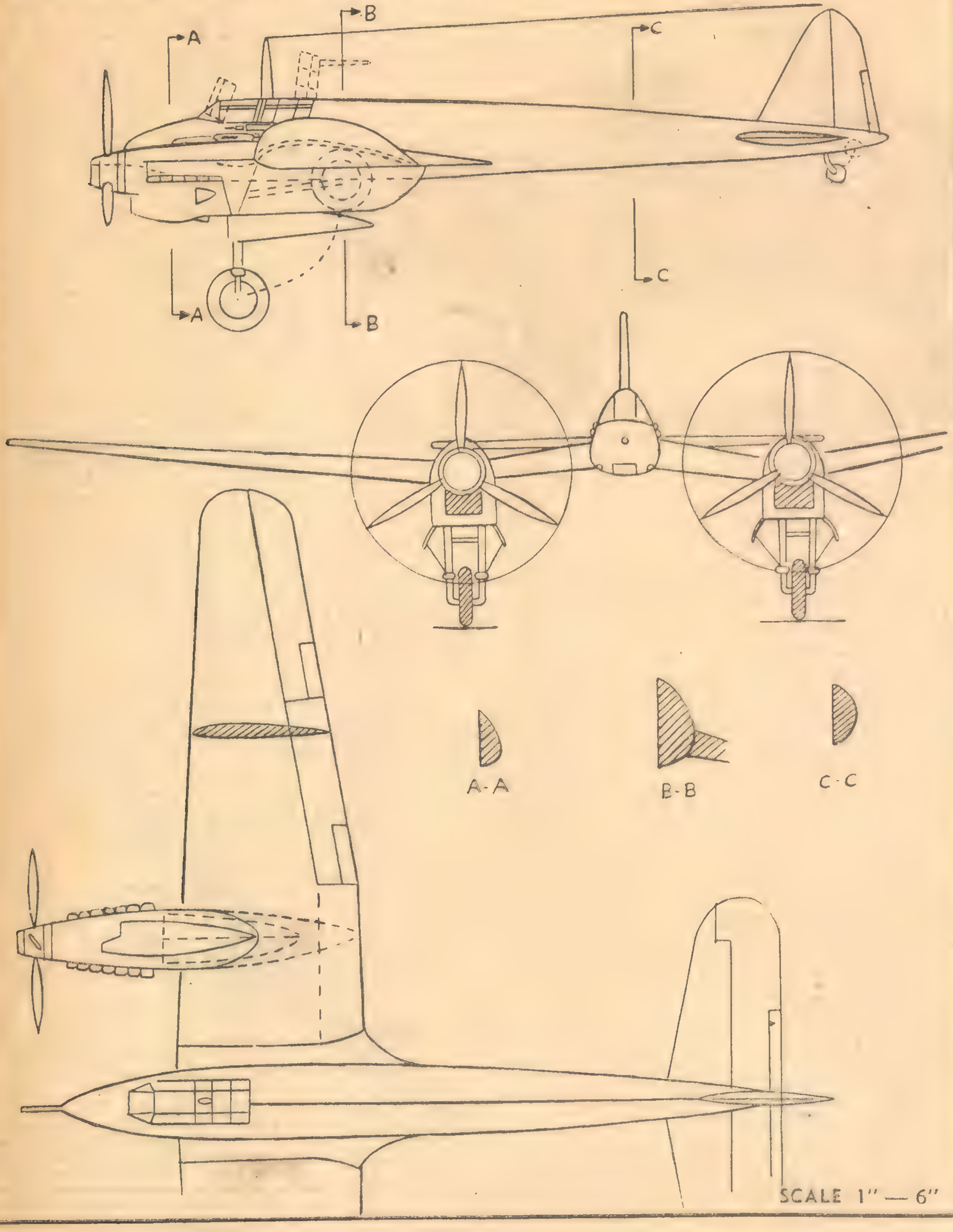
The entire leading edge is hinged to swing downwards, thus affording mechanics a greater chance to repair damage done to the wing by gunfire; it gives easy access to the main spar. Hydraulically-operated split flaps are fitted to the entire trailing edge of the section. Divided ailerons with trimming tabs are fitted to the outer sections.

The tail unit is fully cantilever, with the tail plane set slightly forward of the fin. The comparatively large elevator

(Continued on Page 14)

TWIN-ENGINED GERMAN FIGHTER-BOMBER

FOCKE-WULF FW187 "ZERSTORER"



THE FW 187 IS HIGHLY MANOEUVRABLE

This photograph, from a German source, shows the FW 187 flying upside-down. Although the Germans would not be above faking such a photograph, it is probably quite genuine. At least, the shadows indicate inverted flight and, in the original picture, the ground could be clearly seen.

is aerodynamically balanced. Trimming tabs are fitted to the elvators and rudder.

The under-carriage is fully retractable, including the tail wheel, the two main units being hydraulically operated. They swing backwards and upwards into the engine nacelles, being fully enclosed. Electrically-operated brakes are fitted to the main wheels.

As in nearly all German planes, the crew, in this case of two, are seated close together in one transparent covered cockpit, the covering being hinged to open upwards in two pieces, as shown in the accompanying plans. Owing to the shortness of the nose, the pilot has an excellent view, which is added to by a transparent panel under the nose.

It has been suggested that this panel could be used for bomb aiming when the aircraft is carrying light bombs.

DAIMLER-BENZ MOTORS

Power is suggested by two Daimler-Benz DB 601A liquid-cooled motors, each being 1150hp, but the machine may also be fitted with Junkers Jumo 211 engines of the same horsepower. Both have been seen on the service aircraft.

Notice the unusual type of spinner which forms the hub of the three-bladed propellers. There are, more than likely, German copies of the American Hamilton three-bladed constant-speed variable-pitch propeller.

The maximum speed is given officially as 362 mph (three miles slower than the ME110), and the all-round performance is good, particularly the rate of climb. This is remarkable for a machine of its size, being 3450 feet per minute initially.

The rate of climb diminishes as the aircraft climbs higher and, approaching the service ceiling, which is 39,000 feet, it decreases to 100 feet per minute. The service ceiling is an excellent figure, too, considering the fact that the machine was designed prior to 1939.

Armament of the FW 187 consists o four .5-inch calibre machine-gun mounted in the fuselage, two on eith side and just below the cockpit cove where they may be readily cleared o jams by the observer. Two canno guns are fitted in the fuselage ju ahead of the leading edge of the wi and firing through deep channels o either side of the fuselage.

All the armament is therefore con centrated in the nose of the machin and fires forward, there being no back ward armament. The observer probabl acts as ammunition feeder and als operates the wireless. Light bombs ar carried on external bomb racks mount ed in the centre section area.

POINTS OF NOTE

The entire armament is lighter tha that mounted on the Whirlwind an Beaufighter, but is similar to tha mounted by the ME 110, which is buil under licence by the Focke-Wulf Com pany. Although the ME 110 is some what similar in design to the FW 18 the latter has many outstanding fea tures.

The obvious recognition point is th short nose, which terminates behin the airscrew spinners. The moto cowlings are long, project well in fron of the leading edge of the wing, and the greater part of them is below the wing. The fuselage is even more slende than that of the ME 110 and termi nates in a large single fin and rudder in contrast to the ME 110's twin fins and rudders.

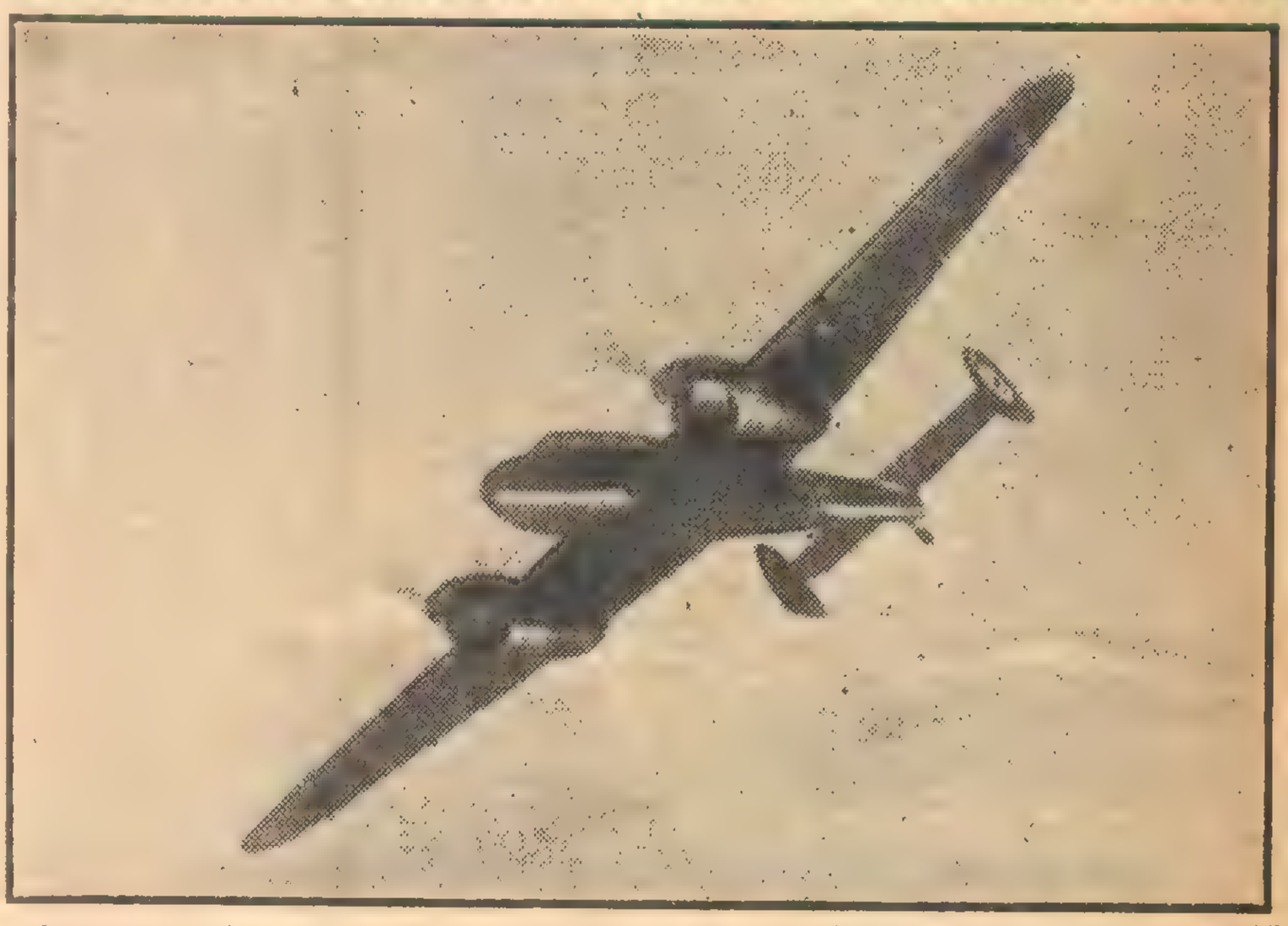
The wing is highly tapered and is situated well to the front of the fuselage. The slight downward rake of the centre section will be clear in any head-on view.

Specifications:—

Span: 50 feet 6 inches.

Length: 33 feet 6 inches.

ANOTHER GERMAN FIGHTER-BOMBER, ME110



Companion plane to the Focke-Wulf 187 is the Messerschmitt 110. Also a twin-engined fighter-bomber, the ME 110 has been in use since the war began and many have been shot down over England.

Height (tail down): 12 feet.
Wing area: 300 sq. feet.
Weight (approx.) loaded: 12,000lb.
Loadings (approx.): Wing, 40lb. per sq. foot. Power, 5.2lb. per hp.
Power: Two Daimler-Benz DB 601A engines.
Horsepower: 2300 (total).
Maximum speed: 362 mph at 19,685 feet.
Speed at sea level: 324 mph.
Climb (initial): 3450 feet per minute.
Range: 1750 miles (approx.).
Service ceiling: 39,000 feet.

SERVICE COLORS

In common with other German types, the Zerstorers are painted dark green on all upper surfaces and sides. The motor nacelles are green on the sides and a very light blue underneath. The wings, tail and fuselage are also pale blue underneath, the lighter color meeting the dark green of the sides just above the bottom line of the fuselage.

Plain black crosses with white outlines are carried on each side of the fuselage and above and below on the wings about half-way out on the movable section. A swastika is carried also, in black with white outlines, on the fixed fin. An identification number is painted in white in front of the fuselage. Each FW 187 also carries some mark to identify to which "Kette" or flight of the staffel to which it belongs.

BUILDING A MODEL

Usually, when a solid model of any plane is constructed, there is little outside the undercarriage, wheels and propellers which can be movable. This machine gives a little scope to the more ardent solid modellers in that, if they so desire, they may make the cabin a workable one. When hinged in the correct place it rises up in the two sections as shown in the plan. However, only the most expert should attempt to do this.

A block for the fuselage and engines, sheet balsa for the wings and tail unit, a pair of small wheels, some celluloid, pins, cement, sandpaper, balsa sealer and finishing lacquers, together with a good sharp knife and razor blade, are required before any attempt is made to start. These may be obtained from the local balsa shop.

First, trace the side view of the fuselage and engines on the block and cut them out to this outline; next cut the fuselage and engines to top view shape. After this, it only remains

BRITAIN'S FAMOUS BRISTOL BEAUFIGHTER

Developed from the Bristol Beaufort bomber, the Beaufighter has proved an extremely valuable plane to Great Britain. Comparable to the Beaufighter is the Havoc night fighter, developed from the Douglas Boston bomber.

for the correct cross section to be carved in. Apply rough sandpaper, then smooth, and the finished fuselage and engines should result.

The tail unit is made in three separate pieces, being first cut to outline shape, then to the correct aerofoil section, which is an equal curve top and bottom of the centre. A quick rub over with the fine sandpaper and the tail pieces are ready to be glued in position on the fuselage. Cement the three tail pieces in the correct position, making sure that the alignment is correct. Hold them in position with pins, until dry.

MAKING THE WINGS

The wings may be made in either one piece, two pieces (one for each wing) or three pieces (the centre section and the two outer wing sections). Carve the correct wing aerofoil in and sandpaper. Connect the wings to the fuselage and cement in place, holding them on with pins until dry. Be careful to check the alignment of the wings and tail unit.

Finally, when dry, the engines are added, the best method being to slot the engine and the wing and slide one into the other. Cement in place and leave to dry. Before adding external details such as the undercarriage, propellers, radio mast and tail wheel, give the machine two to three coats of banana oil or balsa sealer, allowing time to dry between each coat, and sanding with the fine sandpaper. Add the external details and the machine is now ready to be painted.

Paint the machine the correct colors, adding the details as mentioned in the article previously. If you have not made the cabin a separate unit, silver paint with black lines representing the joins will suffice and will make quite a neat job. When finished you can add this plane to your collection.

THERE'S NO SUBSTITUTE FOR WATER

(Continued from Page 10)

sulting calcium bicarbonate crystallises out of the solution as it drips from the ceiling and forms the beautiful stalactites that hang down from the ceiling and the stalagmites that grow up on the floor.

Each drop of water only furnishes a minute amount of calcium bicarbonate, but, in the course of ages, the accumulation is sufficient to build a stalactite of considerable length. There are some small stalactites to be seen hanging from the arches that carry the trams over Eddie-avenue at the Central Railway Station in Sydney. These are formed by the action of water on the lime in the concrete used in the construction of the arches.

Water, therefore, is a marvellous substance. No chemist has yet made a substitute for it. There is no "ersatz" water. It cannot be approached by any other substance in its range and variety. yet it is the most common material we know.

Every time a fire is lit; every time an electric spark is set off; every time an explosion occurs, there is a combination of the essential gases oxygen and hydrogen and the formation of water.

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"BUZZA"
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ALWAYS READY FOR USE
★
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ITEMS OF NEWS FROM A WORLD AT WAR

Beating The U-Boats

CARGO-CARRYING submarines, as well as freighter planes, are included among the US Government's plans to combat the U-boat menace. Senator Lee has stated that both the Army and the Navy were actively interested in the scheme submitted by the submarine designer, Simon Lake, for a fleet of 7500-ton ships, with a surface speed of 12 knots and a submerged speed of eight.

Plans have actually been approved by the War Production Board for the building of 500 Mars cargo (70-ton) flying-boats. It is understood that the Navy has been urged to have 25 per cent. of the air giants built immediately. The Navy has also placed an order with the Henry Kaiser shipyards in California for a 200-ton experimental flying-boat.

Captain Roscoe Turner, before the Senate Defence Committee, recently advocated giant flying-boat freight-carriers. Captain Turner told the committee: "We must rush production of giant transport planes, because cargo ships are being sunk faster than they can be replaced."

Captain Eddie Rickenbacker, "ace" of the last war, has urged use as cargo-carriers of gliders, "whose terrific potentialities are not yet realised."

Synthetic Rubber

THE United States in 1944 will be able to supply rubber for all essential Allied military and civilian needs, the chairman of the US War Production Board (Mr. Nelson) states.

"This year US synthetic rubber output will reach 32,300 tons. with another 73,000 tons for the first half of next year.

"By the end of 1943 US synthetic rubber production will reach 338,000 tons."

The US scrap rubber reserve was estimated as high as 10,000,000 tons. Nothing like this was realised in the recent national scrap rubber salvage campaign.

LOCATES HIDDEN SHIPS

ACCORDING to an announcement by the US Navy Department a new radio device for locating ships and aircraft hidden from sight has been introduced in the United States. It is thought to be similar to British radiolocation. Skilled personnel to operate and maintain the "Radars," as the apparatus is called, must have had experience in the design, construction and operation of the UHF transmitting and receiving equipment, or experience with television and cathode-ray apparatus.

Mustang Fighters At Work

ARMY Co-operation Command American-built Mustang fighters have been operating under the Fighter Command recently in ground-strafing sweeps across the Channel.

Mustangs are the fastest Army Co-operation aircraft in the world, and according to American reports, have a top speed of 400 miles an hour. They carry heavy armament, are powered with a 1150 horse-power Allison V1710 12-cylinder engine, are extremely manoeuvrable, and have a particularly rapid rate of climb.

Pilots have reported that these fighters are remarkably sturdy. The damage some had suffered would have meant the loss of other types of aircraft. An anti-aircraft bullet hit the ammunition box of one Mustang. Most of the cartridges exploded, damaging the wing and sending splinters all over the interior, but the injured pilot made a perfect landing.

* * *

New German Heavy Bomber

ACCORDING to reports, it seems that the Germans will soon be releasing for service a new heavy bomber, the Heinkel 177. This aircraft is even more massive than the Stirling bomber.

"The Heinkel 177 weighs more than 35 tons, with a wing span a foot or two greater than that of the Lancaster. The German bomber looks like a twin-engined plane, but in fact is four-engined."

The four-engined Stirling, one of the world's heaviest operational craft, weighs more than 30 tons fully laden. It can carry eight tons of bombs more than 2000 miles at more than 300 mph.

The four-engined Lancaster carries much the same bomb-load and defensive armor, but is somewhat smaller than the Stirling.

* * *

Fighter-Bombers

RAF fighters will soon be dropping 1000lb. bombs on Nazi targets, according to a report in the "Daily Herald."

"These bombs will be armor-piercing, and will be the largest yet carried by single-engined aircraft," the "Daily Herald" adds.

"Germany's Focke-Wulf 190 fighter is capable of carrying a 1000-pounder, but no single-seater has so far been designed to carry such a heavy bomb.

"The main object of the heavier bomb is to make air attacks against shipping swifter and safer.

"New short-range fighters, designed to take a much heavier bomb than so far carried by a single-seater machine, are being experimented with by German aircraft designers.

"This is the latest development in the sea and air war."

MECHANICAL EARS TO LOCATE PLANES

Long before the sound of an approaching plane is audible in the natural way the faint droning of its motor can be heard in these sound locators. Listening intently, the operators swing the huge mechanical "ears" round about and up and down till they are facing directly the source of the sound. The signaller passes on the information to the anti-aircraft gunners some distance away.

Sulphanilamide For Soldiers

EVERY American soldier will be provided with a package of sulphanilamide tablets and powder, the latter in a container similar to a salt shaker, to sprinkle on wounds, the Secretary of War, Mr. Stimson, said recently.

Mr. Stimson also announced that he is endeavoring to obtain 20,000 additional doctors for the Army by the end of the year.

* * *

U.S. Support For Sister Kenny

RESULTS of tests verifying Australian Sister Kenny's theory on treatment of infantile paralysis were recently published in the Journal of the American Medical Association.

Sister Kenny's theory of muscle spasms in infantile paralysis victims was tested by Dr. Schwartz and Dr. Bouman, of Rochester (New York) School of Medicine.

The AMA Journal in April urged adoption of Sister Kenny's method throughout the United States as fundamental treatment for infantile paralysis.

Last December a committee of the US National Foundation for Infantile Paralysis approved of Sister Kenny's methods.

* * *

To Prevent Fires

A NEW fire-resisting chemical which may be an important help to the United Nations' war effort is announced by Dr. Grinnell Jones, of Harvard University.

When sprayed on wooden surfaces the chemical makes combustion impossible.

Dr. Jones said it was invented by Dr. Walter Juda, who fled from Germany when the Nazis attained power in 1933.

* * *

"Sky Battleships"

MAJOR DE SEVERSKY, noted plane designer, urges that 150-ton sky battleships be built immediately "to attack Tokio daily from San Francisco."

[By way of Midway Island, Tokio is 5042 miles from San Francisco.]

Such planes would not need fighter escorts because they would have sufficient fire-power to fight off any Jap planes, de Seversky said.

"It is almost criminal to use steel for old-fashioned weapons like battleships and cruisers, instead of concentrating upon the conquest of the air," he told the "New York Times."

* * *

Britain's New Sky Terror

BRITAIN'S new anti-aircraft shells were described by a German pilot over Berlin radio as "a pilot's terror."

The pilot, who was in the recent Middlesbrough raid, said: "They resembled flaming shells, which exploded high in the sky, falling down on raiding planes in many little shells."

Major Oliver Stewart, aviation correspondent of the "Evening Standard," predicts a renewed Nazi blitz on Britain as heavy bombers are released from the Russian front.

FORERUNNERS OF AN ALLIED OFFENSIVE

Just as the word "blitzkrieg" belongs characteristically to the Germans, so the word "commando" is peculiar to the small but ever-growing bands of Allied shock troops. In every Allied country these special bands are being trained—forerunners of the mighty offensive force which will yet sweep away the dark forces of evil.

"Educated" Torpedo

AN "educated" torpedo sank a medium-sized American merchant ship in the Mexican Gulf, survivors report.

Look-outs spotted the torpedo several hundred yards on the starboard and running parallel to the ship's course, but mistook it for a large fish.

Suddenly the torpedo turned at right angles and struck the ship, causing a terrific explosion.

The ship carried 406 men, women, and children. Twenty-five people were killed and many injured.

No submarine was sighted.

ROBOT PILOT IN JAP FIGHTER

ROBOT pilot equipment, for use in emergency, is believed to be one reason for the success of the Japanese Zero fighter plane.

It is said that when a Jap fighter pilot finds himself at a disadvantage in a dog-fight he merely engages the robot pilot gear and the control of the plane is taken out of his hands.

For a minute and a half the craft hurtles crazily through the air in all directions, rolling and turning, diving and climbing.

During these manoeuvres the pilot probably suffers a "blackout" until the plane resumes level flight, allowing him sufficient time to recover.

When the craft returns to normal flight pursuing planes are far out of range, allowing it to escape.

New Shipbuilding Records

THE California Shipbuilding Corporation has broken all world records by building a 10,000-ton ship from keel-laying to launching in 41 days—five days better than the previous record.

The yards, built where there was only swamp two years ago, now have 14 slipways and 10 fitting docks.

Many ship parts are fabricated in plants inland, and the ships assembled and completed in the yards.

Three new US destroyers were launched in 23 minutes in the Federal Shipbuilding Drydock Co., Kearney (New Jersey).

The triple launching was made in the same yard which sent four destroyers down the slips in 50 minutes on May 3.

* * *

Axis Needs Diamonds

THE US Customs Commissioner (Mr. Johnson) says the Axis Powers are making extraordinary efforts to smuggle platinum and commercial diamonds out of the United States.

"Dummy firms have been established in non-belligerent countries to circumvent the US blacklist and deceive American exporters," Mr. Johnson states.

"Efforts to get platinum and industrial diamonds indicate that these items are becoming vital to the Axis war machine."

Platinum and industrial diamonds are essential for making precision instruments.

WE DO OUR BEST . . . . .

And at the same time offer apologies to our many good friends and customers for keeping you waiting for "University" test equipment.

However, you may rely upon us to speed up the delivery of your instrument and thank you in advance for your co-operation and understanding.

As you know, the needs of the men in uniform must come first.

Therefore, the instruments we can supply for civil requirements are as a trickle compared to the flood of "University" meters and test equipment being delivered to the Fighting Forces.

In the meantime we invite you to take a peep at some of the highly intricate processes involved in the production of "University" meters at the Radio Equipment Laboratories.

An illustrated brochure describing "University" test equipment is available free upon request.

1.

1. "University" meters undergo extremely careful checking and tests before final insertion into "University" test equipment. Thousands of "University" meters are used in military equipment, such as transmitters, signal units, phones, etc.

3. Fitting tiny meter parts is a job only for sensitive fingers. All Radio Equipment employees are specially selected and trained for all phases of meter and test equipment work.

3.

2.

2. Meter coils are tiny, therefore delicate winding equipment plus great skill in handling is essential.

4. Showing "University" Supertesters undergoing final tests. Every instrument made by Radio Equipment is thoroughly tested and guaranteed.

4.

RADIO EQUIPMENT PTY. LTD.

The Test Equipment Specialists, E.S. & A. Bank Buildings, Bro-dway, N.S.W.
'Phone M6391-2 Telegrams Raquip-Sydney.

★

LET THE WIND CHARGE YOUR BATTERY

One of the many effects of petrol rationing in Australia has been to make it ever so much more difficult for people in country districts to have their radio batteries charged at regular intervals. A few evenings without the radio is sufficient to breed a determination to arrange some method of charging the battery on the spot.

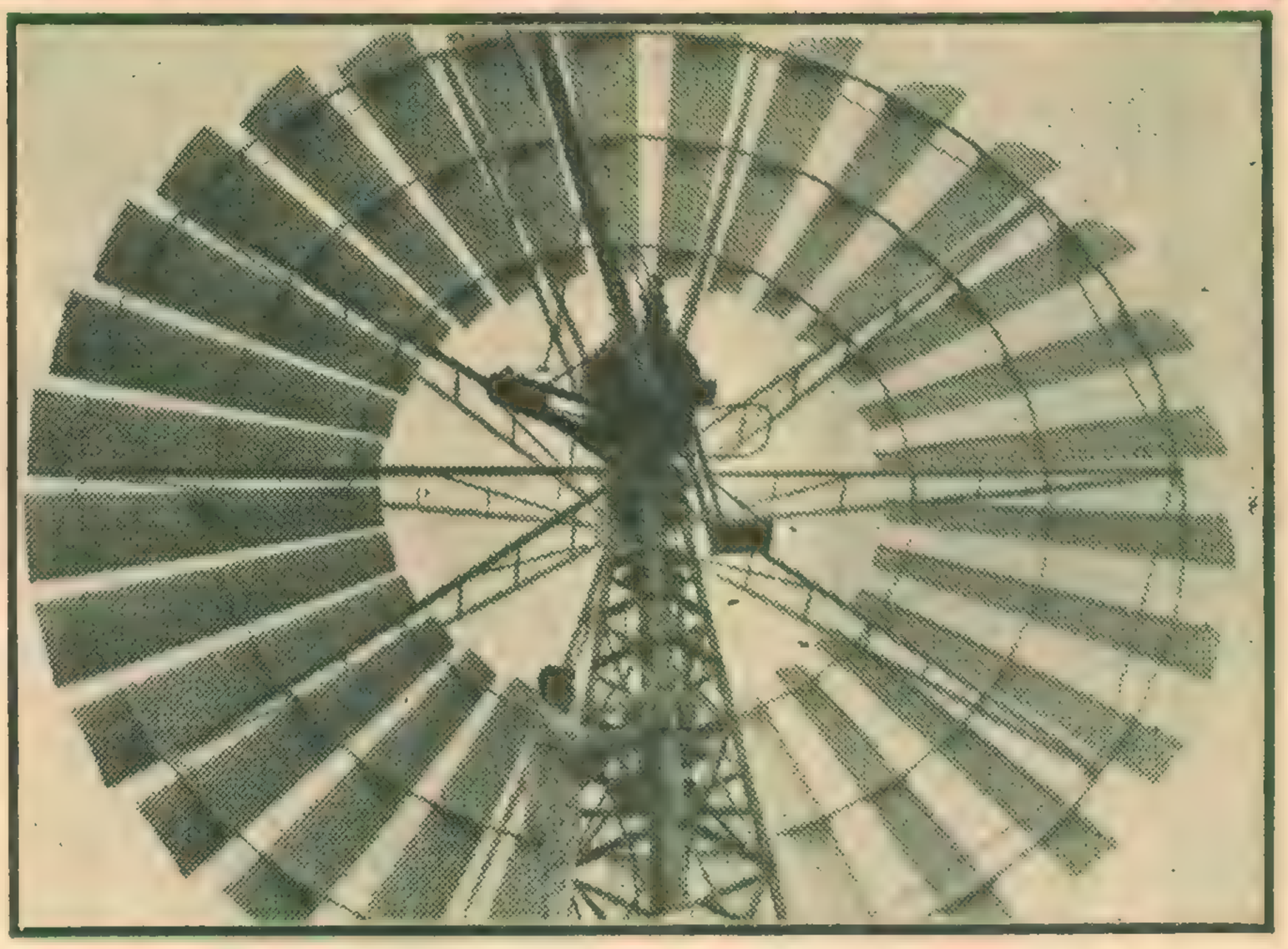


Figure 1. All over the world, the winds are harnessed to pump water and to grind grain. Why not then to charge batteries? The accompanying article, compiled from various sources, contains sufficient information to allow the handyman to construct a wind-driven battery charging unit, at a minimum of cost.

THE most obvious source of power—which, fortunately, is not under the control of the Axis—is that of the wind. If the wind can be harnessed to pump thousands of gallons of water, cannot it be used also to put a few amps into the radio battery?

That our readers have been thinking along these lines has been evidenced of late in our mail. We have had letter after letter asking for instructions as to how to build a windcharger. Past experience tells us that, for every reader who writes in about a certain matter, there are scores of others interested in the same subject, who have not taken the trouble to put their thoughts on a sheet of notepaper. A few years ago, windchargers were readily available on a commercial basis, but, for some reason or other, they seem to have largely disappeared from the market. We use the word "windcharger" in the general sense, because it is a good one. There is an American product sold under that trade name.

GENERAL IDEAS

As far as we are concerned, we have never had the occasion to build up such a thing and we cannot pass on first-hand information in regard to methods of construction. In any case, it is quite a different proposition from constructing an article from one particular kit of parts.

In the construction of a windcharger, one has to make use of all sorts of discarded odds and ends and no two people will have just the same parts with which to work. All that can be done is to pass on a few general ideas and to leave the details to the ingenuity of the individual constructor.

As a preliminary to any actual constructional details, there are a few general considerations, which we have noted in reading over various articles on the subject.

The first consideration is obviously the wind itself. If you live in a hollow or in a district where the wind only blows on rare occasions, then a windcharger will not be much of a proposition. Again, if the winds are purely seasonal, you will have to find other means of charging your battery for a certain portion of the year.

ABOUT THE WIND

A good guide in the matter is the success or failure of ordinary windmills in the district. If you see the blades whirling at regular intervals and the water tanks kept full, then a windcharger will probably keep your radio batteries in similar condition.

An occasional puff of wind isn't much good, because it does not give the generator time to reach charging speed.

by W. N. Williams

The best wind is a consistent breeze around the 10 or 15 mph mark. Even a breeze of from 5 to 10 mph will do a good job if the propeller is of suitable design.

In this matter, we need not say more. You will know your own district and situation and will be able to judge whether the project has a reasonable chance of being successful.

In contrast to the usual windmill, a windcharger is a fairly high-speed device. It is usual to design the propeller along the lines of an aeroplane propeller, having two, three, or four blades, with a radius of about three feet.

Before beginning the construction of the propeller, it is most important to check up on the direction of rotation of the generator and to arrange the pitch of the propeller blades to suit. A small preliminary model is very helpful in this regard as a check. It would be most annoying to finish off the propeller and then to discover that it turned in the wrong direction.

PROPELLER, GENERATOR

The shape of the propeller is an important factor. Furthermore, it must be very accurately adjusted for balance and for tracking. In other words, not only must the blades be perfectly balanced, but they must follow exactly the same path as they rotate. When completed, the propeller must be finished with a good varnish or with several coats of shellac.

In order to simplify the construction and to avoid frictional losses, it is usual to mount the generator immediately behind the propeller and on the same structure.

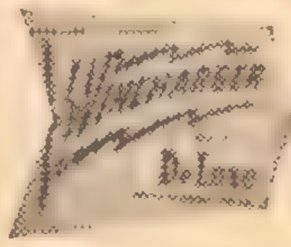
The propeller drives the generator by means of a set of gear wheels, a bicycle chain, or an auto fan belt. The latter would probably tend to be rather stiff. in comparison to the other two methods.

(Continued on Next Page)

CONSTRUCTION

For best results, the generator should be geared up to operate at about three times the speed of the propeller. The generator itself should preferably be one designed to operate at a fairly slow speed.

Most constructors use the generator from a junked automobile for the purpose. We have known constructors to use the generator from an early model "Overland," "Pontiac," "Chevrolet," and a model T "Ford." There are probably quite a lot of other generators equally suitable for the purpose. Generators needing to operate at higher speeds might be pressed into service, but there may be difficulties in gearing them up sufficiently.



We do not profess to be experts in this line. If you are in doubt, the best man to see is the local mechanic—if he hasn't enlisted or gone to the city to do war work.

AVOID FRICTION

Whatever type you use, it is most essential to see that the action of the whole set-up is as free as possible. The bearings of the propeller and of the generator should be quite free, and the coupling medium should introduce the minimum amount of friction. The tension of the brushes on the commutator should be slackened off so that they do no more than make good contact.

The propeller and generator assembly must be mounted well up in the clear, in order to make best use of any wind. It should be fitted with a tail fin and arranged on a suitable swivel, so that it can always face into the wind.

The leads from the generator must be brought out in such a way that they will not twist up as the generator assembly swivels around. One excellent method is to arrange a system of brushes between the generator assembly and the fixed portion of the mast. In this way, both the positive and the negative leads may be brought down.

USE HEAVY LEADS

The brushes may be right up at the top of the mast, immediately beneath the generator assembly. An alternative idea, which has certain mechanical advantages, is to mount the assembly on a long pipe running down the centre of the mast, with the brushes and contacts at the lower end.

Whatever you do in this regard, see that the brushes make firm and positive contact, and use heavy wire for the connecting leads. It is advisable to limit the overall length of the leads to about 50 feet.

In some cases, it may be found that one side of the electrical circuit is bonded to the frame of the generator. In this case, a certain amount of care is necessary to see that there is no possibility of a short-circuit or leakage through so devious earthing pat If the generator h but a single insulated t minal, it is safe to assu that the case forms other connection. Usually t case will be the negative co nection, although it is positive in a few instanc If, indeed, the mast is of me construction, the mast itself may utilised as a return for one side of t electrical circuit, a single brush a conductor being used for the oth return.

Figure 2. Here is a typical wind-driven battery charger, product of the "Wind-charger Corporation," Iowa, USA. Note the reinforcing on the leading edges of the propeller blades and the special governing device along the lines mentioned in the text. The feet swivel to permit mounting on a gable roof. Photograph by courtesy of Messrs. J. B. Chandler Pty. Ltd.

Being exposed to the wind a weather, and in a position whe frequent attention is unlikely, t propeller and generator assembly mu be made as far as possible waterpro This may involve the construction shields around portions of the gen rator and the liberal application grease, paint and varnish.

The actual steps necessary will va with the parts used, but the matter is very important one.

CUT-OUT ESSENTIAL

The generator must be fitted with cut-out, to prevent the battery d charging through the generator when is not charging. As a rule, the sam cut-out as used in the original aut mobile may be used. It can be fitte either to the casing of the generator located at the foot of the mast, whe it can readily be adjusted.

In practice, some slight readjustme may be found desirable to make th best of the current available. A dis carded auto ammeter should also b used to indicate the charging current.

The charging current will vary con siderably with the speed of the wind With high winds it may rise up aroun the 15 or 20 amp. mark. Too high charging rate is undesirable, both fo the battery and for the generator. A far as the battery is concerned, th optimum and the maximum permissibl charging rate may be determined b consulting the manufacturers or some one who has an intimate knowledge o such matters.

The charging rate may be reduced o adjusted by inserting a variable resist-ance in series with the positive lead t the battery. The higher the resistance in circuit, the lower will be the charging rate.

You may be fortunate enough to pick up an old low-resistance rheostat o fairly large dimensions. Alternatively, a tapped arrangement may be made up

RATE OF AMPERE CHARGE AT VARIOUS WIND VELOCITIES

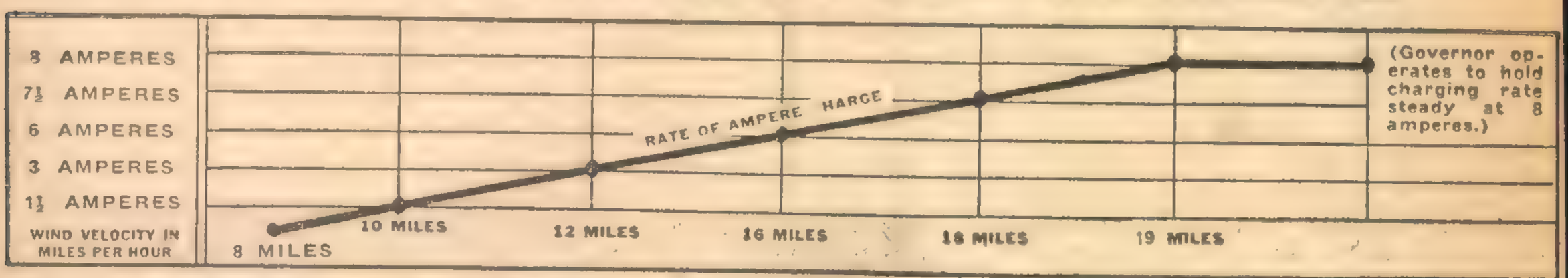


Figure 3. A curve showing the relationship between charging current and wind velocity for a charging plant similar to that illustrated above. Note how the governor prevents the propeller rotating at excessive speeds and limits the charging current to a maximum of 8 amperes.

with the aid of a tapping switch and a length of fairly heavy resistance wire.

With very heavy winds, the speed of rotation of a wind-driven generator may become very high indeed, and, under these circumstances, a severe strain is imposed on the whole structure. This is not desirable, but the structure may stand up to it, if solidly constructed.

LIMITING THE SPEED

Some windchargers have a swivelled tail with chains or ropes coming to the base of the tower, permitting the propeller blades to be turned out of the wind, when necessary. The more ingenious constructor may evolve some tail arrangement to turn the propeller aside automatically when the wind becomes too strong.

Still another method of regulation is to arrange a pair of steel plates, mounted on an axis at right angles to the line of the propeller and conforming to the arc of a circle concentric with the propeller hub. At ordinary speeds the plates are edge on both to the wind and to the direction of rotation. With high winds, due to centrifugal or other force, the plates tend to flap outwards from the hub, acting as air brakes, and also deflecting some of the wind from the surface of the propeller blades.

INCREASED VOLTAGE

A regulator of this general description is fitted to at least one commercial windcharger. Whether you take the trouble to arrange some form of speed control is for yourself to decide. A speed control is certainly a desirable feature, but complicates the construction considerably.

The terminal voltage of an accumulator on charge rises considerably above the nominal voltage. Thus, the voltage across a six-volt accumulator on charge may rise to eight or more volts. For this reason, if for no other, it is not wise to try and charge the battery while still connected to the radio receiver. The high voltage across the filaments may damage the emission of the valves.

In the case of an auto receiver, the valves used are invariably of the indirectly-heated type, which are not nearly as easily damaged as ordinary battery valves.

TWO ACCUMULATORS

The ideal thing, when you have a windcharger, is to have two accumulators—one operating the receiver, the other on charge. If you only have the one accumulator, try and arrange the charging bench in a convenient position so that the battery may be changed over from radio to charger with a minimum of effort.

When the charger is not in use, be sure to fix the tail so that the blades are turned out of the wind.

The normal auto generator is wound to deliver 6 volts. It is therefore suitable for direct connection to a 6-volt accumulator, with the possible addition of a series resistor to adjust the charging current. The same generator may be used to charge lower voltage accumulators, provided the series resistor is made large enough to limit the current to safe proportions. In this regard, a discarded auto ammeter in circuit is an invaluable asset.

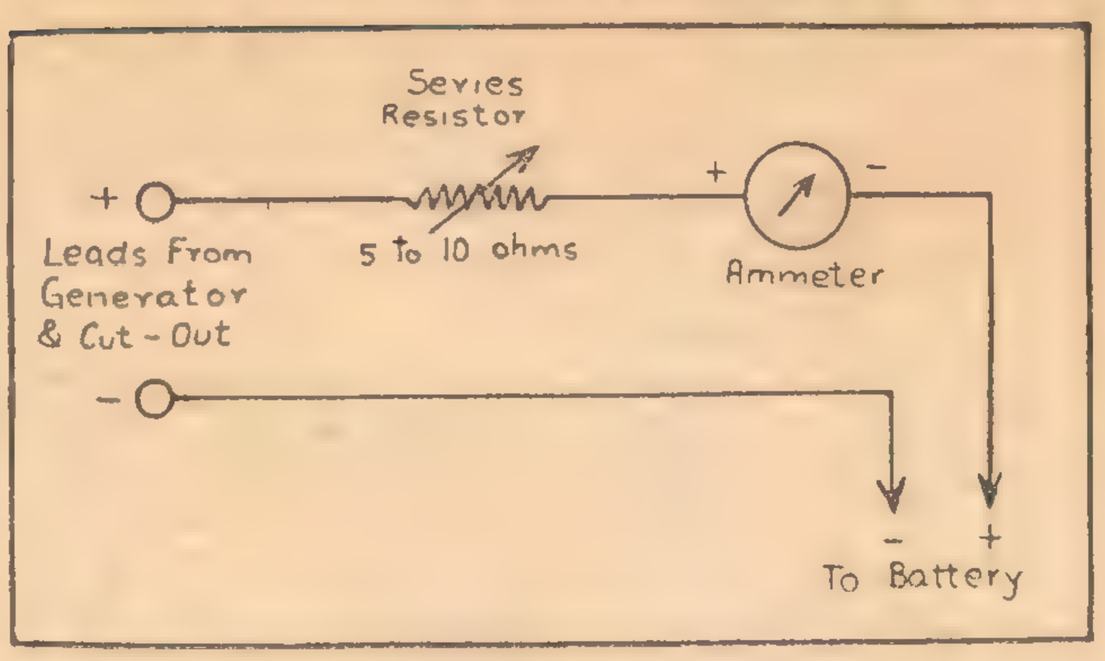


Figure 4. The electrical connections are very simple. The negative lead from the generator passes straight to the negative terminal of the battery on charge. A variable resistor is included in series with the positive lead to permit adjustment of the charging current and an ammeter to register the current flowing

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A WORD OF WARNING

If your car is up on blocks, the accumulator may be pressed into service alternatively with the regular radio battery. If both car and radio batteries are of the 6 volt variety, there will be no complications.

However, if your radio only requires 2 or 4 volts for the filament supply, the connections should be made only across one or two cells, as the case may be. Extreme care is necessary, for it is the easiest thing in the world inadvertently to connect the A battery leads right across the 6 volts—with disastrous results. Time and time again we hear of people doing this.

Take it in turns to use different cells of the battery, so that all are periodically charged and discharged.

(Continued on Next Page)

IRC
Initiative – Resourcefulness – Cooperation
to advance the interests of the industry
This Type BT Resistor is an example of the homogeneous "Metallized" resistance material bonded to the outer surface of a sturdy glass tube and encased in a protective covering.
Voltages up to 100,000 at 100 watts (and greater) are made possible in the new Type MY High Voltage Resistors by a spiral formation of "Metallized" resistance element on a ceramic base.
In IRC Type MF High Megohm Power Resistors, the "Metallized" element is applied solidly over a ceramic surface. Excellent characteristics at ultra-high frequencies of more than 75 megohms result.
WHAT ARE "Metallized" RESISTORS?
"Metalized" Resistors differ from conventional units in that a homogeneous film of high resistance material is applied and bonded at high temperatures to insulating bases of various types The result of this process is a resistance element of predetermined resistance value and accuracy. This process, time-tested throughout years, has been utilized and perfected for seven distinctive types of resistors, each one internationally known for its exceptional quality.
As an outstanding example, the IRC type BT insulated resistors, comprising the unique "Metallized" filament element and specially developed insulating phenolic covering, have humidity characteristics hitherto unobtained. More than 10 cycles of alternate two-hour immersions in 100deg C. and 0deg.C. salt solution followed by two-hour loadings at normal rating result in an average change in resistance value of less than 10%
The inherent characteristics of "Metallized" Resistors are stability, low noise level uniformity, non-ageing, low voltage and temperature coefficient and freedom from major humidity effects
No other type of resistance material holds such an outstanding record of success None holds such broad possibilities for future development
WM. J. McELLIGOTT CO.

CONSTRUCTION

PLANS OF WINDCHARGER BUILT BY Mr. E. J. LEESON

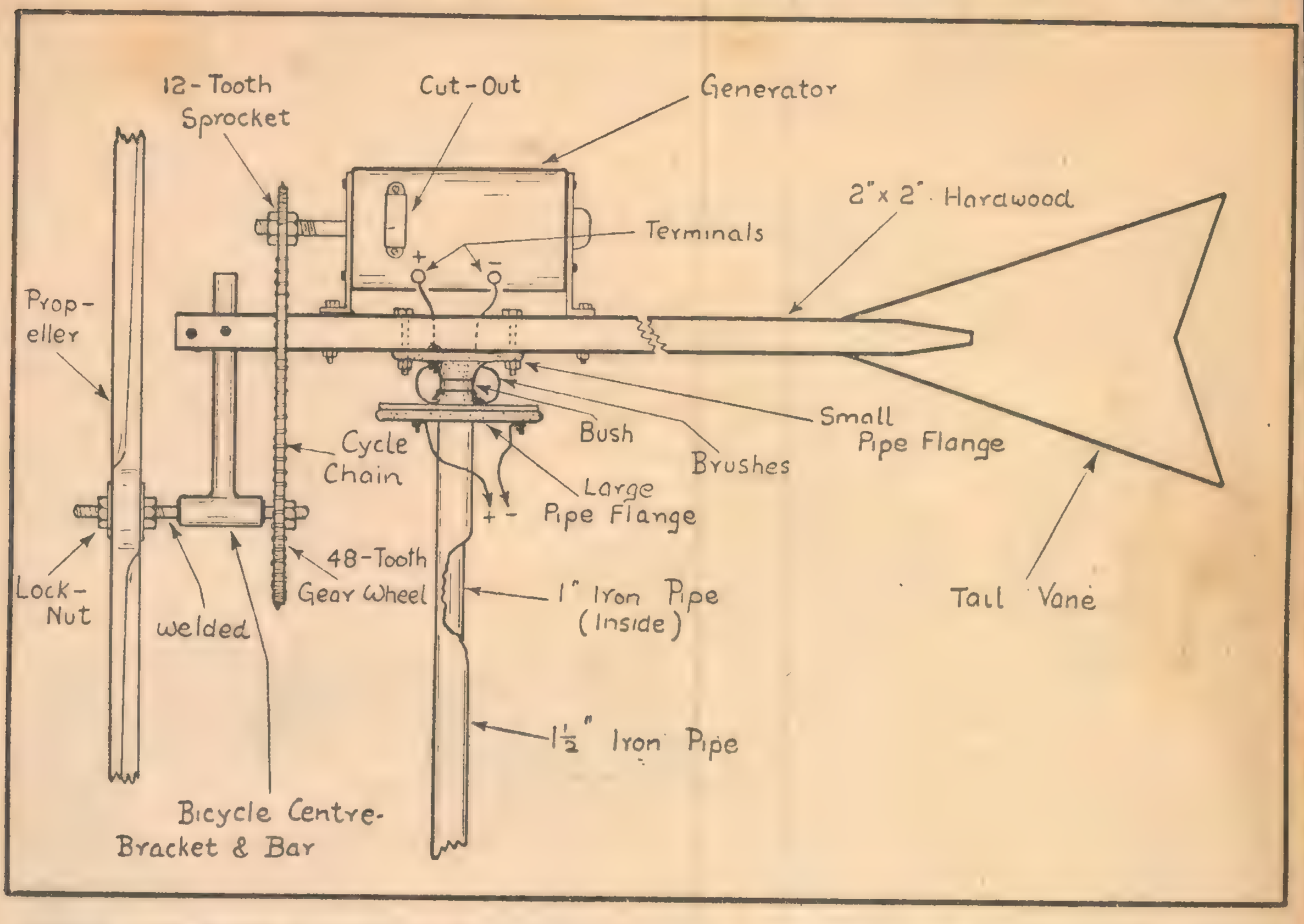

Figure 5. A sketch giving the essential details of a windcharger built by one of our readers, Mr. E. J. Leeson, of "South View," Goodwood, Queensland. The sketch is not to scale, but gives a good idea of the method of construction. The 1½in. pipe is secured to the supporting stand, the whole unit being free to swivel on the smaller pipe, which rotates inside it. Power from the generator is conveyed to the fixed portion of the stand through a pair of brushes, which are described elsewhere in detail.

For easy and positive connections to the battery, fit all the necessary leads with large alligator clips. Simply to twist the end of the wire around the lead binding post is quite unsatisfactory. Such a connection is usually a very poor one, and effectively blocks the flow of most of the precious current.

Be careful to mark all the leads and the battery terminals clearly, positive and negative. A few hours of charging in reverse polarity may well be disastrous, both for the battery and for the charger.

PERFORMANCE VARIES

The performance of a windcharger varies tremendously with its design and with the location. Under the best conditions, a windcharger installation will not only keep the radio battery fresh but will also supply a small lighting system.

Allowing for inevitable losses and inefficiency, a windcharger made up from junked parts and installed in a reasonably good position should have no difficulty in keeping charged the battery supplying the average vibrator receiver. In the case of the conventional battery receiver, where the accumulator supplies only the filament drain, the problem would be even simpler.

We are indebted to one of our readers —Mr. E. J. Leeson, "South View," Goodwood, Queensland—for a diagram and brief description of a successful windcharger which he has constructed.

The accompanying sketches give a good idea of the constructional details. Enlarging on Mr. Leeson's letter, the various steps in the construction are as follow:

Obtain a 3-foot length of 1½in. diameter iron piping, threaded for a short distance at one end. On to the threaded end screw a flange, with the narrow portion to the end of the pipe. The flange should be jammed tight into position or brazed so that it will not move.

Finish off the end of the pipe so that it is perfectly flat and flush with the edge of the flange. A good finish is necessary, because the end surfaces of the pipe and flange are to form one surface of a bearing on which the whole of the windcharger assembly will rotate.

The pipe itself has to be clamped to the supporting tower by some suitable means, depending on the construction of the tower. As mentioned earlier, the tower should be high enough to carry the propeller well clear of surrounding objects. If necessary, it should be stayed to prevent undue vibration and sway.

CONTACT RINGS

The dimensions of the supporting tower in the immediate vicinity of the propeller should not be too great, and there should be ample clearance for the propeller, no matter in which direction it is facing.

The next step is to obtain a piece of bakelite and from it to cut a ring having about the same outside diameter as that of the pipe flange. A large hole should

(Continued on Next Page)

ANY BRIGHT IDEAS?

WE anticipate that many of our country readers will be very interested in this article and, no doubt, quite a few will seriously consider constructing a windcharger for themselves. If you have ever built up one of these units and if you have any bright ideas in regard to their construction and installation let us know about it so that we can pass it on to other readers who may be interested in the subject. We may not be able to put your idea into the form of a major article, but we will be pleased to publish the essentials.

be filed in the centre of the bakelite ring so that it will fit snugly down over the neck of the flange and rest on the flat portion.

Two flat copper or brass rings should be manufactured, about ¾ inch wide. The actual diameters are not important, but the rings should fit, one inside the other, with good clearance and without overlapping the flange on the one hand or shorting to the metal in the centre.

Three holes should now be drilled through each ring and then right through the bakelite and the flat portion of the flange. The hole through the copper ring should be countersunk so that the head of a countersunk bolt will not protrude through above the surface.

The holes through the flat portion of the flange should be large enough to allow the insertion of a piece of rubber or bakelite tubing, in order to insulate the bolts from the flange.

RINGS MUST BE FLAT

Finally, the rings and the bakelite disc should be assembled to the flange and held in place by suitable bolts. It will be necessary to place small bakelite washers beneath the nuts to complete the insulation process. A couple of solder lugs beneath two of the nuts will serve for the electrical connections.

Do not tighten the nuts more than necessary or the copper rings might spring and warp. Finally, fill the heads of the screws with solder and file flush with the surface of the copper ring.

It is most important to see that the rings are perfectly concentric with the pipe and that they are as free as possible from bumps. A little care at this stage will be repaid later on by freedom from electrical troubles.

Having completed the larger pipe assembly, obtain another piece of pipe two feet long and having an outside diameter of one inch. This pipe has also to be threaded at one end for a short distance to receive a flange.

Obtain a flange to fit the smaller pipe, clean up the surface of the smaller end and screw the flange on so that the smaller end is away from the end of the pipe. Once again, see that the flange is very tightly jammed or brazed in place and finish off the end of the pipe flush with the flat surface of the flange.

FITTING THE PIPES

Next, clean up the outer surface of the smaller pipe and drop it down the inside of the larger pipe, making sure that it rotates freely. If it is too loose, cut out a long strip of metal shim to make it fit more snugly. A good fit here will prevent quite a lot of vibration when the propeller is rotating at high speeds.

Returning now to the work on the smaller piece of pipe and the flange attached thereto. Well, towards the outer edge of the small flange, and in a direct line with the centre hole, drill two ⅜-inch holes. Through these holes will pass the bolts holding the piece of hardwood, which carries the rest of the assembly.

Two smaller holes have to be drilled through opposite sides in the outer surface of the flange, this time to carry the two wiper contacts. The holes should be at right angles to the line

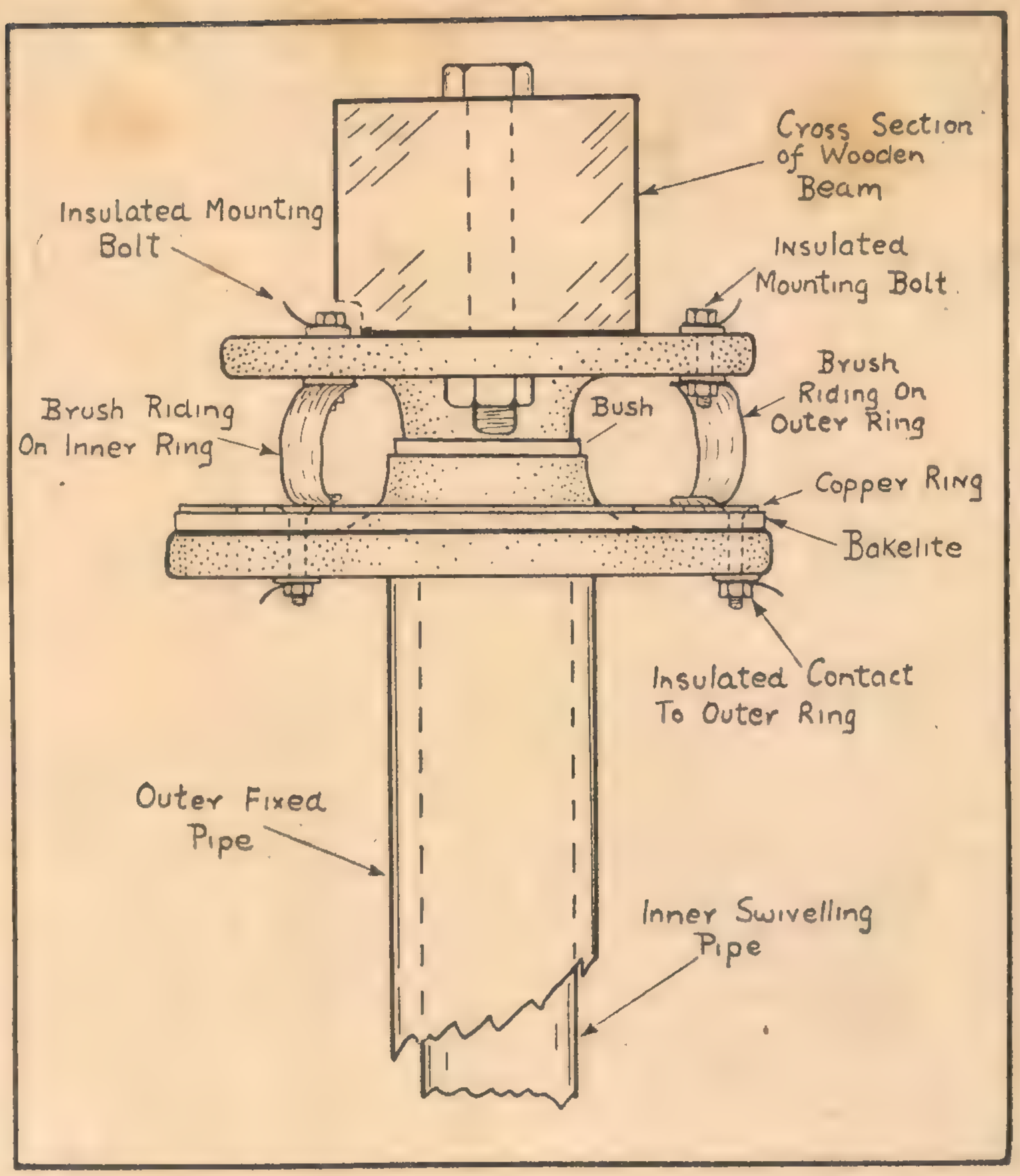

Figure 6. An enlarged sketch of the swivel joint and the wiping contacts. Both the wiping contacts and the contact rings are assembled to the pipe flanges, but they must be insulated therefrom. The contact must be good in all positions of the swivel joint. The brushes should not short across between the two rings or tend to buckle when rotating in either direction.

of the ⅜-inch mounting holes previously mentioned.

The holes will not be at the same distance from the centre of the flange, but must be in such a position that the wiper contacts beneath them will bear directly onto the two contact rings on the lower flange.

WIPING CONTACTS

The holes also need to be considerably oversize so that the bolts passing through them can be well insulated with rubber or bakelite tubing. The heads of the bolts and the nuts need to be isolated by suitable bakelite washers, solder tags being placed above the flange for connection to the generator terminals.

The wiping contacts should be of fairly solid spring brass, bent into the shape of a half moon, with a lip on the trailing edge so that there is no tendency to dig into the contact ring when rotated in either direction.

When the pipe assemblies have been completed, slip them one inside the other and rotate them in either direction, imposing lateral strain as you do so. See that the wiping contact is good in all positions and that there is no chance of shorting across. You can

(Continued on Next Page)

YOU WILL NEED THESE PARTS:

- 1 3in. length of iron piping, 1½in. outside diameter, with flange.
- 1 2in. length of iron piping, 1in. outside diameter, with flange.
- 1 centre-bracket from old bicycle frame, complete with portion of one bar, balls and ball cups.
- 1 axle to suit above, complete with 48-tooth gear wheel.
- 1 12-topth bicycle sprocket.
- 1 bicycle chain.
- 1 4in. length of ⅝in. diameter bolt, with suitable nuts.
- 1 4ft. length of 2in. x 2in. seasoned hardwood.
- 1 6ft. length of wood suitable for propeller.
- 1 piece of galvanised iron for tail vane.
- 1 discarded 6-volt auto generator, complete with cutout.

Together with sundry nuts and bolts, sheet metal for brackets, copper and brass for brushes, bakelite, battery leads, &c.

SHOWING THE CIRCULAR CONTACT RINGS

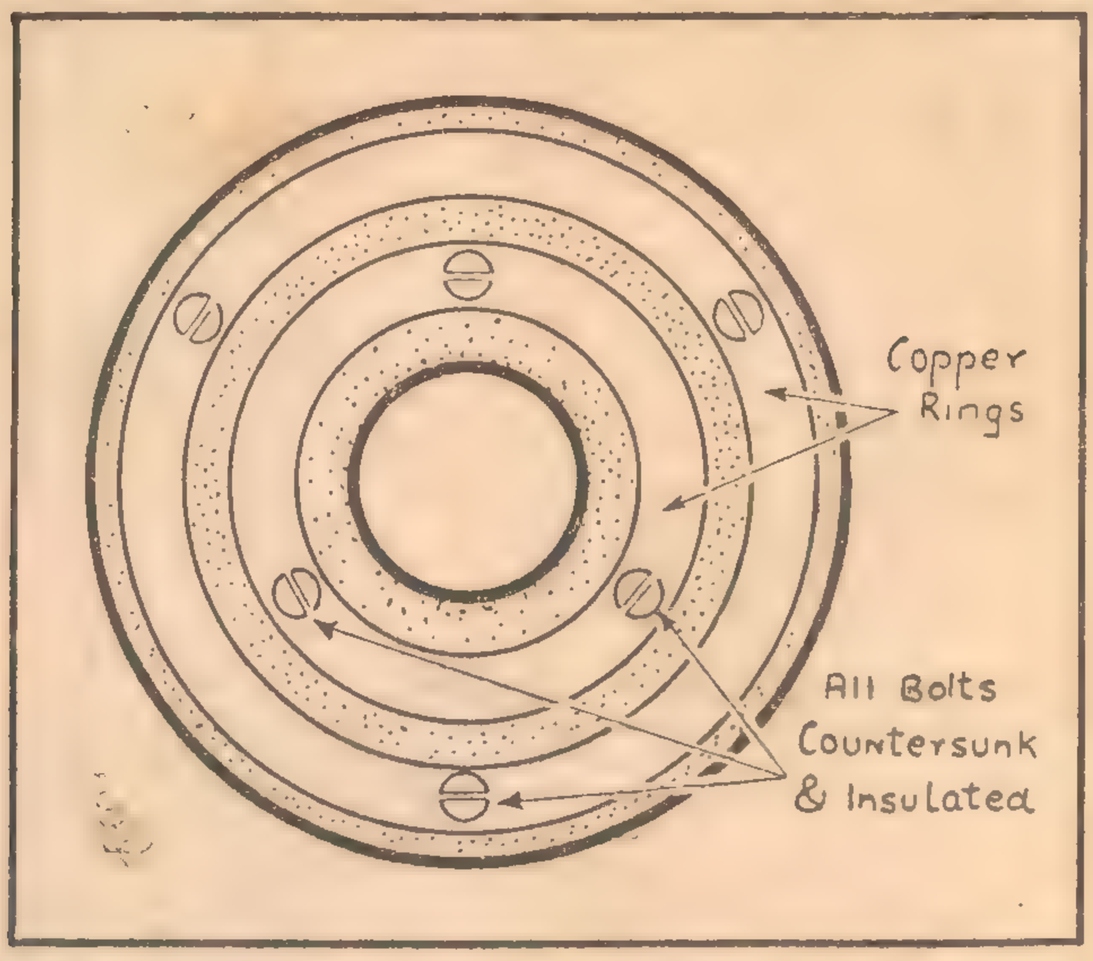

Figure 7. This sketch is not to scale but illustrates the arrangement of the circular contact rings on the larger pipe flange. A flat piece of bakelite is interspersed between the contact rings and the metal flange for purposes of insulation. The countersunk bolts pass right through the rings, the bakelite and the flange, being insulated from the latter by means of bakelite or rubber tubing and bakelite washers. When the rings have been assembled, test them to see that they do not short to the pipe flange.

afford to make the tension fairly solid, since there will be ample power in the vane to overcome any friction here.

If there is not enough clearance between the inner surfaces of the two flanges, it is a simple matter to make up a bush of suitable dimensions to place between the two pieces of pipe. In any case, it is as well to insert a washer in this position.

HARDWOOD BEAM

As we mentioned earlier in the article, it is possible to use the metal work of the assembly as one conductor, thus simplifying the construction of the brush contacts.

The generator and the propeller are carried on a piece of hardwood about four feet in length and of cross section 2in. square. The hardwood should be planed, sanded and coated with a good varnish or paint to keep out the moisture.

Well towards one end are drilled two ⅝in. holes, in such a position as to allow the hardwood to be bolted to the smaller pipe flange. The actual position will vary somewhat, according to the clearance necessary between the driving sprockets and the supporting tower.

Before you actually drill the holes, it is a good plan to arrange the parts in the approximate positions they will occupy when the job is completed. This will minimise the likelihood of drilling holes in the wrong place and thus unnecessarily weakening the timber.

GENERAL ASSEMBLY

The generator is mounted immediately above and astride the pipe flange so that its weight is squarely above the swivel bearings. You will probably have to make up special mounting brackets to carry the generator. These will naturally need to be robust and bolted firmly to the hardwood beam.

To the remote end of the beam is attached a tail vane, made from treated plywood or flat galvanised iron. The actual shape and dimensions of the vane are not particularly critical, but it must be large enough to hold the propeller into the wind. The further the vane is from the swivel joint, the more effective it will be.

The centre bracket and axle of an old bicycle are adapted to carry the propeller. One of the two V bars is cut off short near the centre bracket, the other well up towards the top of the frame.

PROPELLER HUB

Next, remove the axle and have a threaded length of ⅝in. bolt welded to one end. Make sure that it is perfectly true with the axle, and clean up any burrs or blobs on the surface. Replace the axle in the centre bracket, setting the balls in grease and tightening the cups just enough to give a firm bearing.

To the short end of the axle, fit a 48-tooth gear wheel, using the normal cotter pin to lock it in position. Spin the gear wheel and see that it runs true on the axle and that the welded extension on the other end is also dead true.

The latter point is most important. Any misalignment here will lead to tracking errors in the propeller and will necessitate delicate packing at the propeller mounting.

CENTRE-BRACKET

The centre bracket is secured to the hardwood beam by cutting a circular hole through the latter so that the tube of the bicycle frame is a very tight fit. The centre bracket should only be far enough away from the beam to allow clearance for the gear wheel.

If the tubular bicycle frame is a tight fit in the wood, a single bolt right through the lot will prevent the frame from turning or from slipping up and down.

By some suitable means, secure a 12-tooth sprocket to the shaft of the generator, making up a length of bicycle chain to couple the sprocket and gear wheel. This gives about the correct ratio, although other ratio should be arranged, if necessary.

In the layout of all these parts you will need to exercise considerable care. For mechanical reasons, the generator and propeller hub should be as close to the hardwood beam as possible, the chain being shortened to suit.

THE DRIVING CHAIN

It goes without saying that the gear wheel and sprocket should be in perfect alignment to obviate the risk of the chain coming off at high speeds. The chain itself should be in good condition, and neither too tight nor too slack. When the whole thing is finally set up, its action should be quite free, without being sloppy. As we mentioned earlier, the tension of the brushes may need to be slackened off a little.

If the generator is completely enclosed, it will only need a coat of paint to stop rust. On the other hand, you may have to manufacture some kind of a housing to keep rain and dust from the inside of the generator and the cut-out.

The propeller has to be bolted to the threaded length of ⅝in. bolt, mentioned earlier. It is as well to arrange, for the whole generator assembly to be balanced about the swivel, so as to eliminate continuous strain in the one direction. However, the pipes will need to be packed to prevent vibration when the propeller is turning.

PROPELLER DESIGN

The final matter is in regard to the design of the propeller. As one might imagine, the design of the propeller is a most important factor in the success or failure of the project. Actually the design is subject to variation according to particular load and wind conditions and the whole problem is one for aeronautical rather than radio engineers.

However, we can afford to overlook the fine points in the design and make up something that will nevertheless work. If you have ever made up propellers for model aeroplanes, you will find that the experience will stand you in good stead, for the shape of the propeller required is much the same as those for model aeroplanes. The

OTHER ARTICLES ON WINDCHARGERS

FOR those who may be interested, the following are a few of the articles which we came across while following up this subject:

"A Successful Windcharger Design," Wireless Weekly for January 21, 1938.
"Bright Idea For The Windcharger," Wireless Weekly Trade Supplement for October 30, 1936.
"Getting Power From The Winds," QST for March, 1934.
"A More Efficient Impeller For Wind-Driven Generators," QST for April, 1935.
"Simpler Form Of Wind-Driven Charger," Sun News-Pictorial Hobby Book.
"Build A Wind-Driven Generator," Modern Mechanix How-To-Build-It for 1935.
"Wind-Driven Generator," Popular Science for August, 1938.
"Wind-Driven Battery Charger," Popular Science for August, 1933 (Reprinted herewith).

following paragraphs will give you a good general idea of the design of propellers for ordinary windchargers.

The propeller must be made of a good close-grained wood, which must be soft enough to carve and yet not so soft as to be easily bruised or to twist away from the locking nuts at the hub.

It will be required to stand up to very difficult weather conditions, varying from hot sun and dry winds to occasions when the blades will be driving at high speeds through rain and hail. The timber must, therefore, not be of a type which will split easily and must be well coated with good varnish or paint.

As a rule, the propeller of a windcharger is about six feet from tip to tip and is of the two-bladed variety. The greatest width of the blade is between five and six inches, and the pitch, towards the ends of the blades, about fifteen degrees.

CARVING THE BLADES

It is usual to round the tips of the blades. They are widest towards the tips, narrowing to approximately half the maximum width just outside the hub, where the propeller widens again to give maximum strength.

The blades must be carved so that the propeller will rotate in the right direction for the particular generator used. The pitch, usually about fifteen degrees at the tip, should gradually increase to a maximum in the vicinity of the hub.

The cross-section of the propeller blade should resemble the aerofoil section of an aeroplane wing, having one side more or less flat and the other markedly curved, with the thickest portion well towards one edge.

The propeller should be cut and mounted in such a way that the flat surface is facing the wind, the curved surface away from the wind. As the propeller rotates, the thicker edge of the blade should lead, the finer, tapering edge trailing.

If the wood is rather soft, it is sometimes helpful to bind the leading edge with a strip of duck or light canvas, glued and varnished in place. An alternative is to reinforce it with a strip of very light gauge sheet copper.

CHECKING BALANCE

The surface should be as smooth as sandpaper will make it, and quite free from bumps and irregularities. It must be perfectly balanced. It is as well to work on both blades simultaneously, checking the balance from time to time, as you work.

The thickness of the blades should gradually decrease towards the tips. When the carving is complete, the balance should be accurately checked by setting the propeller up on a long nail. For this reason, it is as well only to drive a small hole through the hub to start with.

The heavier blade may be lightened by taking shavings from the surface, without, however, upsetting the symmetry of the blades. After painting, the balance should again be checked Actually, slight corrections can be made by giving an extra coat to one blade.

(Continued on Next Page)

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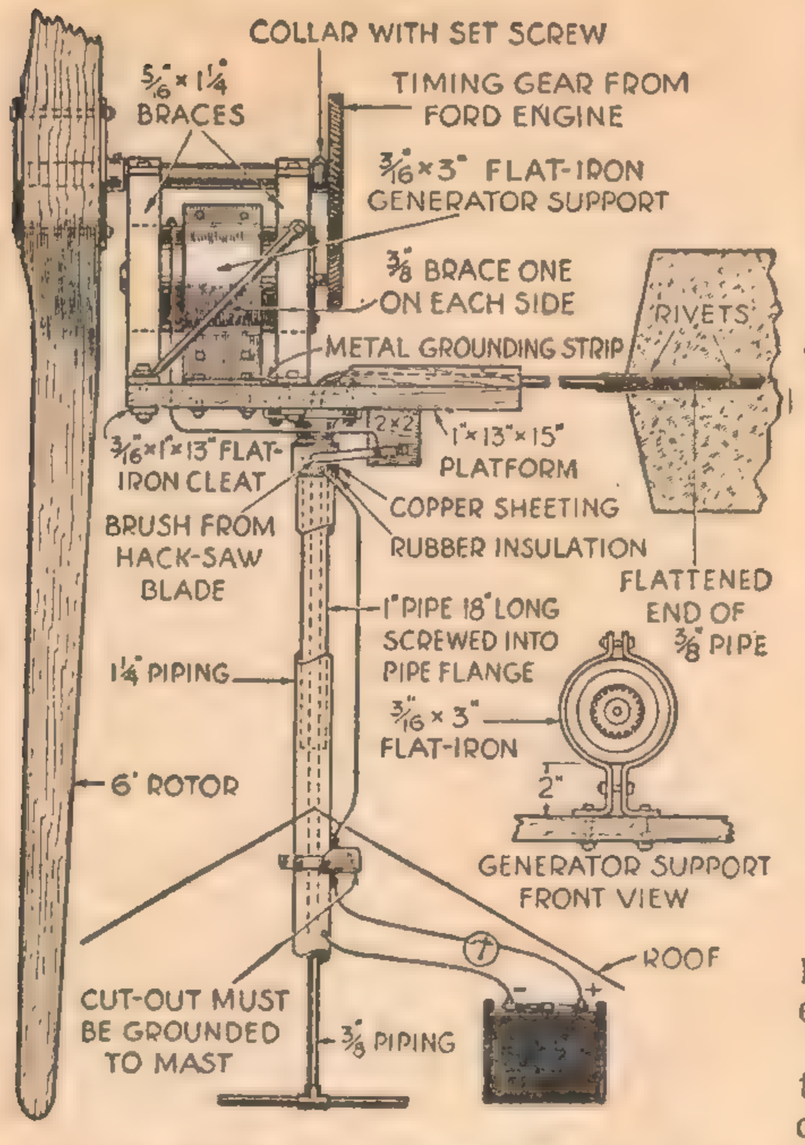
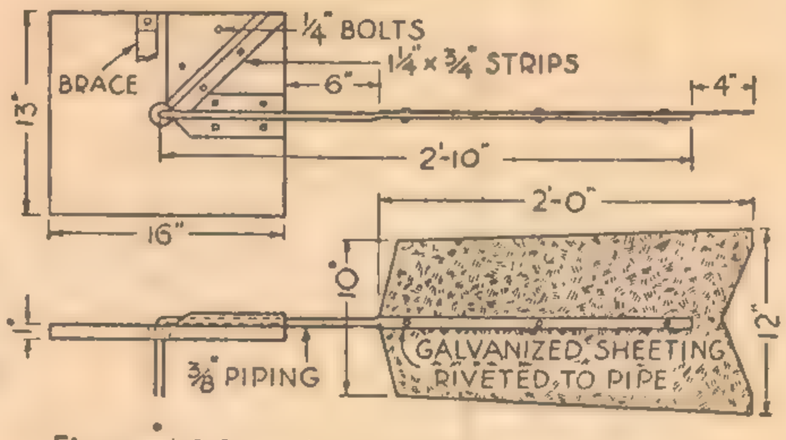
CONSTRUCTION

AN ALTERNATIVE WINDCHARGER DESIGN





Figures 8,9. An alternative design for a home-made windcharger. The generator and propeller assembly is mounted on a wooden platform, which swivels on a small pipe dropped down inside a larger one. The propeller revolves on wooden or brass bearings and drives the generator by means of two discarded gears. Note how the tail is attached to a third pipe, bent at right angles and passing down the centre of the other two pipes.

At the same time, tracking can also be checked. If the direction of the pilot hole is slightly out, due correction may be made when drilling the larger hole. Any slight error due to misalignment of the hole could be balanced against possible misalignment of the welded axle. When the proper position is found for the propeller, it is as well to arrange a keyway or a pin to hold the propeller, in addition to the locknuts and washers.

FOUR BLADED PROP.

In the windcharger built up by Mr Leeson, it appears that the propeller is a four-bladed type, being two 6-foot propellers crossed at the hub. The diameter is six feet and the radius three feet.

In the particular windcharger here described, the balance could be checked accurately by mounting the propeller in the proper position but setting the balls in light oil for the purpose. The grease used for normal running would be too heavy to allow really accurate results.

With the foregoing instructions and diagrams, the average handyman should not have too much difficulty in reproducing the windcharger built up by Mr. Leeson. True, it may necessitate a certain amount of hunting around junk yards and a few shillings for welding and parts, but remember that the finished article will save pounds in the long run.

ALTERNATIVE DESIGN

The alternative set of constructional drawings on this page are reproduced from the August, 1933, issue of the "Popular Science Monthly," from an article by L. G. Heimpel, Professor of Agricultural Engineering, Macdonald College, Quebec, Canada.

Space does not permit the construction to be discussed at any great length, but the general idea should be clear enough from the drawings

As in the case of Mr. Lesson's charger, the unit is arranged to swivel on 1in. diameter piping, dropped down the centre of a pipe of larger diameter. A flange is fixed to the end of the smaller pipe and, to this flange, is bolted a wooden platform 16in. by 13in. This platform carries the generator, the propeller and bearings and the tailpiece.

THE WIRING

The negative side of the electrical circuit is bonded to the metal piping so that only one wiping contact is required, to convey the positive potential to the fixed portion of the mast.

The wiping contact is made up by wrapping a sheet of rubber around the outside of the fixed pipe and then wrapping a piece of sheet copper out-

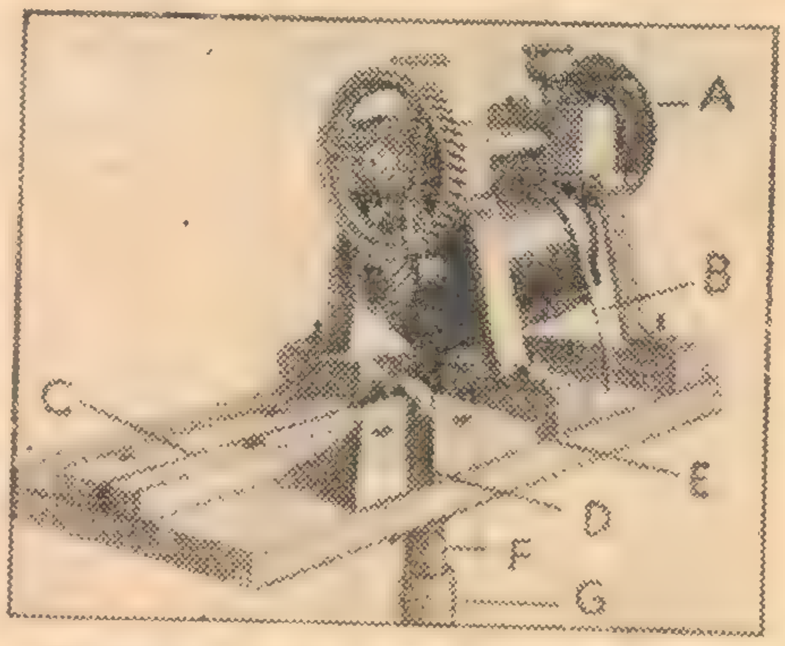


Figure10. Showing how the various components are mounted atop the platform. Note particularly the cleats which hold the tail vane assembly. A is the propeller flange; B the positive wire to the sliding contact brush; C, D, E, are grooves for the vane bar; F and G are pipes.

side that again, so that the sheet copper is insulated from the metal piping The copper may be soldered where it overlaps, the joint being filed quite smooth.

The other portion of the wiping contact takes the form of a short, springy metal blade fixed to a small 2in. x 2in. platform affixed to the lower side of the main wooden platform. The whole thing must be so arranged that, as the generator assembly swivels around, the blade bears firmly at all times against the copper contact ring around the outside of the pipe.

The appropriate electrical connections must be made to the blade and to the copper ring. The former connects to the positive terminal of the generator, the latter to the positive terminal of the battery. The diagram shows the cut-out connected in the negative lead between the battery and the fixed metal pipe.

THE TAIL VANE

The arrangement of the tail unit is very interesting. The tail vane is of metal and is bolted to a long piece of small diameter piping, such as conduit. The piping is bent at right angles, the tail vane being fixed to the short end and the other end being dropped down the inside of the swivelling pipe.

On the rear of the wooden platform are arranged a number of cleats, so spaced out that the tail vane will drop in between them, either in direct line with the propeller shaft, at an acute angle with it, or at right angles to it.

The idea is to mount the fixed pipe on the roof of a shed or outhouse and to arrange matters so that the small diameter pipe attached to the tail comes right down through the roof to within easy reach. To alter the set of the tail vane, it is only necessary to push upwards on the smaller pipe so that the horizontal portion clears the cleats on the platform.

Then a twist in the appropriate direction will bring the pipe over one of the other cleats. When the pipe is released, it will drop into the appropriate channel, and its own weight will hold it in that position till further notice. This certainly seems a very simple and convenient method of controlling the propeller speed or of preventing it turning altogether. The small tube should preferably be fitted with a short handle, for ease of control.

GENERATOR DRIVE

The generator is of the six-volt variety from any one of the light cars mentioned earlier. The propeller was mounted on a piece of 7-8in. cold-rolled steel shafting, and a couple of old gears were pressed into service to give a step-up ratio of about three-to-one.

The bearings could be made of metal, although in the original they were made of wood, cut to shape, drilled and then boiled in linseed oil. Hard maple or birch blocks are recommended, if wooden bearings are used. Care should be taken to see that the holes are drilled in alignment, and oil cups should be fitted to minimise wear and to ensure freedom of movement.

The bearings are bolted to flat iron brackets, securely fastened to the main wooden platform. It is not possible to give dimensions for these smaller parts, since the dimensions vary considerably with the particular components used in the construction.

The gears themselves may be enclosed in an oil bath. However, the author states that he has known of outfits constructed along these lines

which have run for years with the gears greased only on rare occasions. Naturally, however, the better the lubrication, the longer the device will last and the more satisfactory will be its operation.

THE PROPELLER

The propeller design given with this charger appears to be quite good, and may be used in connection with other chargers. Reference should be made to the earlier remarks on the subject.

The propeller is cut from a piece of wood 6ft. long, 7in. wide and 3in. thick. The propeller should be made of some close-grained wood, reasonably hard and of a variety which is not likely to split and warp after exposure to the weather.

It is worth while going to quite a lot of trouble about the propeller, for the whole performance of the unit will depend on how well the propeller is made.

Having made up the generator unit, turn it over by hand and make quite sure which way the propeller must rotate. Just to make doubly sure that you have things right, it is a good plan to whittle a small propeller a few inches long as a model. This can be used to verify the direction of rotation and to identify the front and back and the leading and trailing edges of the blades.

Now take the large piece of timber, roughly dress it and clearly mark front and back. Mark also the exact centre point and the leading and trailing edges of the respective blades.

MARKING THE WOOD

Now turn it edge on and, on either edge of each blade, mark out the taper towards the tips of the blades. You will note that the thickness of the propeller at the hub and for 8in. either side of the hub is 2 15-16in. Towards the tips it tapers to a minimum width of 1in.

Having marked the propeller, proceed to cut off the surplus wood with saw and plane, until the side section is exactly as required. Note that the wood is cut from the rear of the propeller, the flat side facing into the wind.

Now lay the propeller flat side or front upwards and proceed to mark out the front view, according to the drawings. Note that the tips of the blades are rounded and that the leading edge is more nearly straight than the trailing edge.

CUTTING TO SHAPE

It is essential that the outlines of the two blades be identical. If you have any difficulty in this regard, make up a template of one blade from cardboard or sheet metal, and outline the other blade from the template.

Now proceed to cut out the blade, making sure to keep the saw vertical as you cut. If you have made a template, it can be applied also to the back of the blade, although it will be slightly short, because of the taper of the rear surface.

The final and the most delicate operation is to carve the blades to the cross-section shown in the sketches. Note that the flat edge faces into the wind, the camber being to the rear. It may be helpful to make up a set of templates

PROPELLER DESIGN

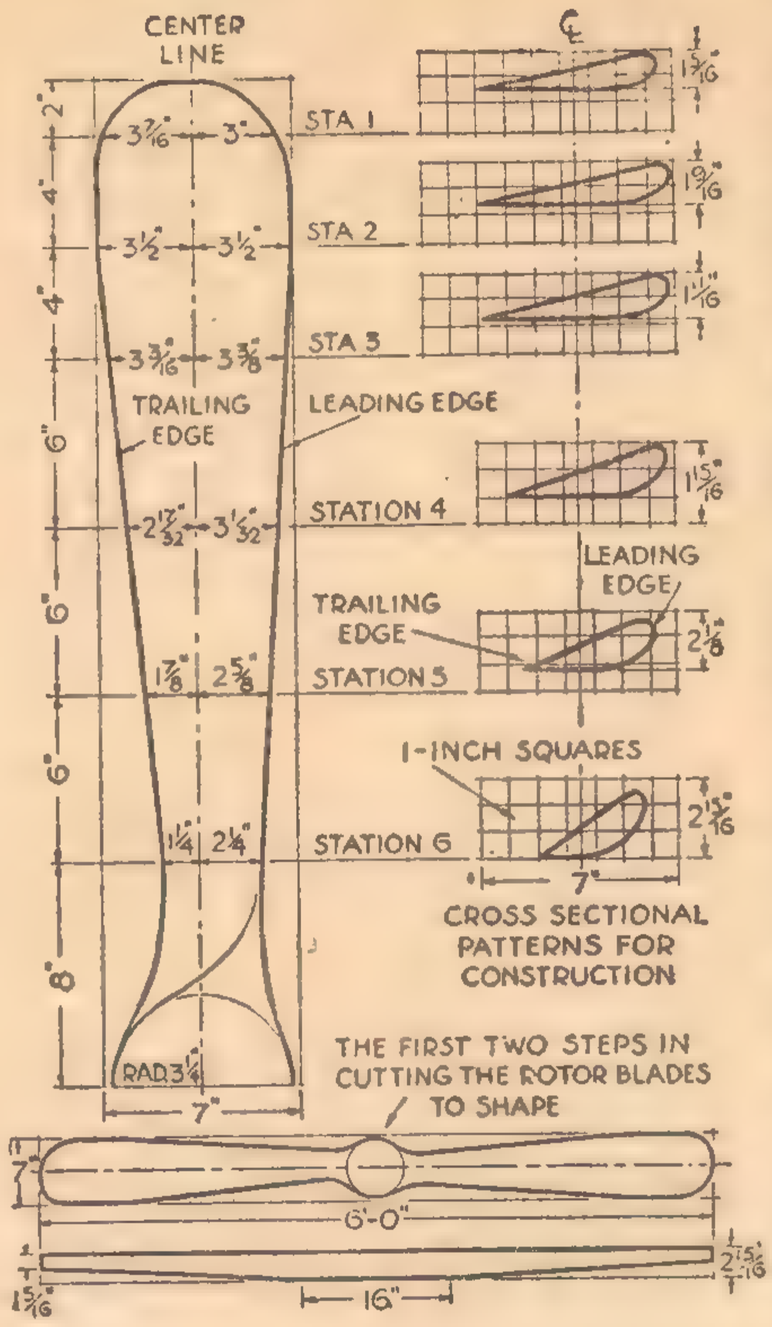


Figure 11. This drawing gives all the essential details for carving a propeller for a windcharger. Begin by tapering the propeller block to the dimensions shown in the bottom sketch. Then mark and cut out the blades as viewed from the front. Finally, carve the blades to the cross-sections shown.

CONSTRUCTION

from thin metal to check the blades at the specified points. The thicker edge is the leading edge.

Between the specified points, the camber must gradually change so that one cross-section merges gradually into the other. Try to keep both blades as symmetrical as possible, and do not be too hasty in your cutting. Once you have cut the wood away, you can't cut it on again.

FINISHING TOUCHES

At the hub, round the edges slightly and merge the outline into the camber of the blades.

When complete, the propeller must be checked for balance, and necessary adjustments made. Then it must be finished and made weatherproof with a good paint or varnish.

The final job is to mount the propeller on the shaft and lock it in position. See that it spins freely and that the blades track as they rotate.

Well that, for the time being at least, is our story in regard to wind-driven battery chargers. We trust that it will provide food for thought for the many readers who have written in for information on the subject.

As we hastened to explain at the beginning of the article, the construction of a windcharger from discarded parts calls for a lot of ingenuity on the part of the builder. You may be able to follow the published designs very closely, or you may have to devise some altogetehr different scheme. We only trust that this article will set you on the right track.

If you consider that your scheme is better than ours, don't hesitate to write to us about it. If we can find the necessary space, we will gladly pass it on to other readers, with due acknowledgment of the source.

A New Era In Rail Transport

(Continued from Page 6)

Hamilton, Dilworth and Prescott started shooting out 600-horsepower, 50-mile-an-hour switchers, and 6000-horsepower passenger engines that would make 117 miles an hour. Today, there are more than 700 switchers operating, along with about 130 of the passenger swifts.

For years, back in the minds of Hamilton and his associates, was the idea of a freight Dieselectric. Moving freight always was a railway headache.

Trains were slow and had to switch in and out of the main lines to let the "varnish strings" go by. Engines had to be refuelled and rewatered frequently. Heavy power pounded the track out of line; an engine had to pack along 80 tons of water; even the best locomotives had to get slack in a long string of cars, and jerk them, one by one, to a start, causing drawbar breakage and long delays.

EXPERIMENTAL ENGINE

So, when they could get a day off from making switchers and passenger engines, Hamilton, Dilworth and Prescott planned a Dieselectric, and finally built an experimental engine. They ran thus all over the country, without publicity, in good weather and bad, 83,000 miles over 20 railways, up heavy grades and down them, with overloads and excessive speeds. Finally they were a million dollars down—but they had a locomotive that would outpull anything else on wheels, and they knew what was wrong about it.

They ran the experiment into the workshop, and used it as a model for No. 100. They demonstrated the No. 100 to the Santa Fe Railways, and she sold herself in jig time. There wasn't any argument—the big Jeep outperformed the best steam power the road had, at much less expense of operation.

BRAKING PROBLEMS

Hamilton, as an old railway engineer; remembered that our freight headache was getting a heavy train down a mountain grade. The only way was to use the brakes, run slowly and stop every few miles to let the red-hot brake shoes and wheels cool off. This wore out thousands of brake shoes and ruined wheels. which flaked off. Going downhill was slower and more expensive than going up. Hamilton told Dilworth something ought to be done about it.

(Continued on Page 53)

A FEW FACTS ABOUT SPEAKERS

A radio receiver, with respect to its fidelity and power output, can be no better than the speaker permits. When a receiver designer is thinking of producing a "High Fidelity" receiver, a midget receiver, or an ordinary medium-priced console, he is forced to pay considerable attention to the type and size of speaker to be used.

Mr. L. B. GRAHAM,
Principal of the A.R. COLLEGE.

THE actual dimensions of the speaker do not give accurate indication of its fidelity or power handling ability, although it is usual for a large speaker to be able to handle a greater power than a smaller speaker. There is a large range of speaker sizes to choose from. There are midget speakers about 5 inches in diameter, medium-sized speakers about 8 inches, and large speakers of the 12-inch variety.

The midget speaker is designed for use in portable and mantel receivers, where size is a governing factor. These speakers are not capable of handling much power, and are seldom very satisfactory from the point of view of fidelity. This is largely due to the small cone surface area, the limited size of the associated baffle board, and the rather high natural resonant frequency of the cone assembly.

Ordinary 7 and 8-inch speakers are usually capable of a wider frequency response, and have considerably greater power-handling ability than the smaller 5-inch models They are the type used in most medium-priced console receivers

In the same way, 12-inch diameter speakers usually have an even better frequency response, especially as far as bass is concerned, and a greater power-handling ability than the 8-inch size. These 12-inch speakers are the types used in better-class receivers, and also for public address work. In most instances, the price of a speaker is a good guide to its capabilities.

The moving coil speaker, now almost universally used, is of two types—the "electro-magnetic" and the "permanent magnet." In one case the field is energised by d-c flowing through a coil or electromagnet, while in the other a permanent magnet is used to provide the field energisation.

THE PRINCIPLES

The principles by which the moving coil speaker operates are quite simple. A coil, to which a paper cone is attached, is suspended in the "air gap" of space between the poles of the magnet. This coil is called the "voice coil," and is connected to the secondary of the speaker transformer The transformer and voice coil provide the plate load impedance for the power tube in the receiver.

The polarity of the field magnet remains fixed, and the strength of the magnet constant When an audio voltage is applied to the voice coil, it causes current to flow through it first in one direction and then in the opposite direction

This creates a magnetic field around the coil, which reverses its polarity every half cycle.

When the polarity of the magnetic field around the voice coil is opposite to the polarity of the field magnet, the coil is pulled in, as the two, opposite poles attract each other. On the other half-cycle, the two poles become alike and repel each other, causing the coil to move outward

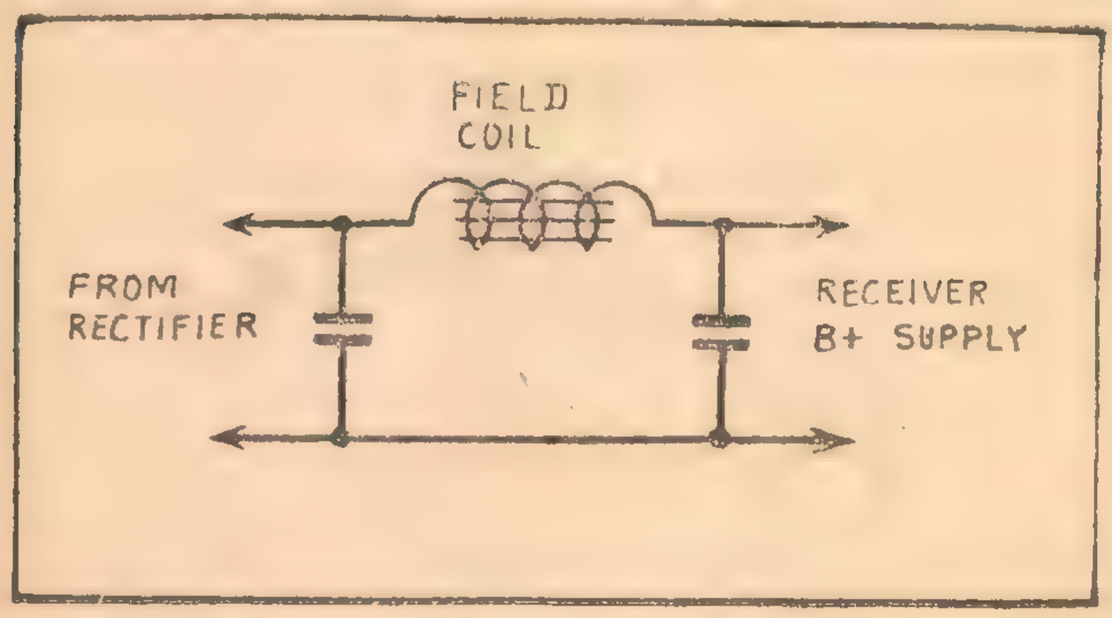


Figure 3. In an a-c mains receiver, it is usual to find an electro - dynamic speaker, the so-called "Field" windings being connected in series with the high tension supply. In this way the desired magnetic field is created, the field windings also serving as a high tension hum filter.

As the changes in polarity of the voice coil's magnetic field change in step with the alterations of the audio frequency, the movements of the coil and, likewise of the cone, which is attached, will be at a rate corresponding to the audio frequency currents from the power tube.

The cone then moves backwards and forwards a certain distance and at a certain speed. The forward movement of the cone pushes the air in front of it, and sucks the air behind it. When it changes its direction, it reverses this effect. A pressure is produced at the back and a rarefaction in front.

NEED FOR A BAFFLE

These changing air pressures at low frequencies can quite easily balance out without moving away from the speaker. For example, when the changes are slow, there is plenty of time for the pressure in front of the cone to cause air to slide around to the back and counteract the rarefaction created there. The result is that the changing air pressures, representing the sound, do not travel away from the speaker, and we therefore do not hear the low frequencies.

To prevent this happening, a baffle is used The baffle is a large board or box in which a hole is cut the size of the cone on the speaker, and the speaker mounted so that the cone is in the position shown in Fig. 2. The path over which the air has to travel to reach the back of the cone is made very much longer and, even at low frequencies, the air has not time to travel this distance.

BAFFLE AREA

The lower the frequency that we wish to hear, the larger must be the baffle. High frequencies are not affected this way, because the movements of the cone are too rapid to give the air time to move from the front to the back of the cone.

A large cone will move a larger volume of air than a small cone However, a large one is heavier, and may not be able to move as far at a high speed as a smaller cone. This means that it will normally be most efficient at low frequencies.

The small speaker has a comparatively light cone and coil which, although it does not disturb anything like as much air, is able to move more easily at high frequencies. The small speaker is therefore somewhat lacking in bass response because the cone cannot move enough air; but gives good high frequency re-

sponse because it is light enough to move rapidly.

It will thus be seen that a large cone is necessary to produce a sufficiently large air movement at low frequencies to give good bass response, and a small, light cone is best at high frequencies.

CORRUGATED CONES

"High Fidelity" speakers have a large cone made of special material, suspended lightly to permit easy movement. The moving coil is often wound with aluminium wire further to reduce the weight. The cone is often stiffened at the centre and ribbed or crimped around its surface.

At low frequencies the cone moves as a whole. At higher frequencies only the inner portion may move, thus reducing the mass of cone which the voice coil has to set in motion at these frequencies.

This idea is not exclusive to "high fidelity" speakers, and it is quite usual to see even small speakers with crimped cones.

High fidelity speakers give good output from about 50 cycles per second to 7000 or 8000 cycles when used with a suitable amplifier.

"TWEETER" SPEAKERS

To obtain greater output at very high frequencies, a "Tweeter" is often used. This usually consists of a moving coil or crystal speaker with a very small cone, lightly suspended. It is sometimes made with a short horn which directs the high frequency sounds.

A baffle is not used with the tweeter, as we do not want any sound at low frequencies from this speaker. In fact, special filter networks are generally used between the amplifier and speaker to prevent much energy at low frequencies from reaching the tweeter.

The designer must be sure that the speaker chosen is capable of handling the required amount of power. A speaker which is meant to operate on a maximum power output of 5 watts will not give satisfactory results if operated on a power output of 8 or 10 watts.

Overloading in this manner results in distortion. Furthermore, the turns of the voice coil may be loosened, causing rattling. The paper cone is apt to rattle and the suspension system may be damaged permanently.

"PERMAG." SPEAKERS

Permanent magnet speakers, as the name implies, use a permanent magnet to supply the field magnetism. These speakers are rather more expensive than the electromagnetic type, but are used in battery-operated receivers or amplifiers.

They are also commonly used as extension speakers, for operation at a distance from a receiver or amplifier, because they only require one pair of wires to provide the signal current, while an electromagnetic type would require additional wires to supply current for the field coil.

Due to their lower cost, electromagnetic speakers are generally used in all mains-operated receivers. The field coil has a direct current passed through it, which makes the soft iron pole piece in the centre an electromagnet of considerable strength. The outside shell is also made of iron, and serves to provide a path for the magnetic lines of force, so that they concentrate in the air gap.

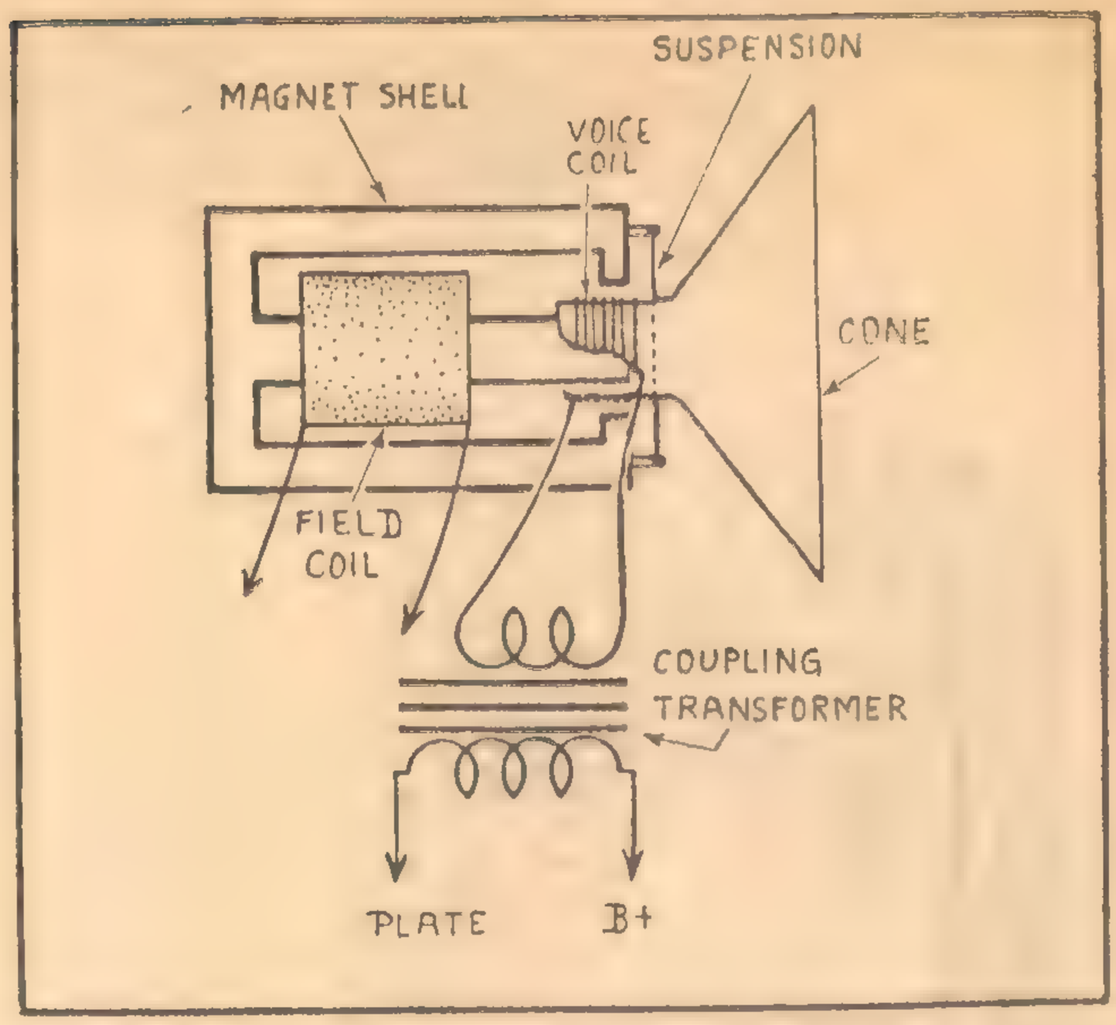


Figure 1. Illustrating the principles of an electro-dynamic loudspeaker. Direct current, passing through the field windings, energises the magnet and sets up an intense magnetic field across the air-gap. Audio currents, passing through the voice coil cause it to move in and out, driving the cone at the same time. The voice coil must be held in a central position by means of some suitable suspension.

MAGNETIC FIELD

The strength of the field depends on the number of turns and the current flowing through the coil. As the coil consists of a large number of turns of wire, it will have a certain d-c resistance; therefore, when a voltage is applied across the coil, a current will flow through it, determined by the voltage and the resistance. The product of this voltage and current is the power in watts dissipated by the field.

The most common field resistance is about 2000 ohms, and in small speakers any more than 5 or 6 watts of power in the field would cause overheating, due to the smallness of the wire gauge and the absence of much metal to dissipate the heat.

Too much heat causes expansion and warping, so that the voice coil is jammed in the air gap in which it should move freely.

Larger speakers, especially "high fidelity" speakers, require from 10 to 20 watts of power in the field to give satisfactory sensitivity, and a greater degree of "damping" to the voice coil movement, so that the speaker can more faithfully reproduce sharp impulses of sound known as "transients." In these speakers the coil is larger and of thicker wire; also there is a greater bulk of metal surrounding it, so that the extra power does not overheat it.

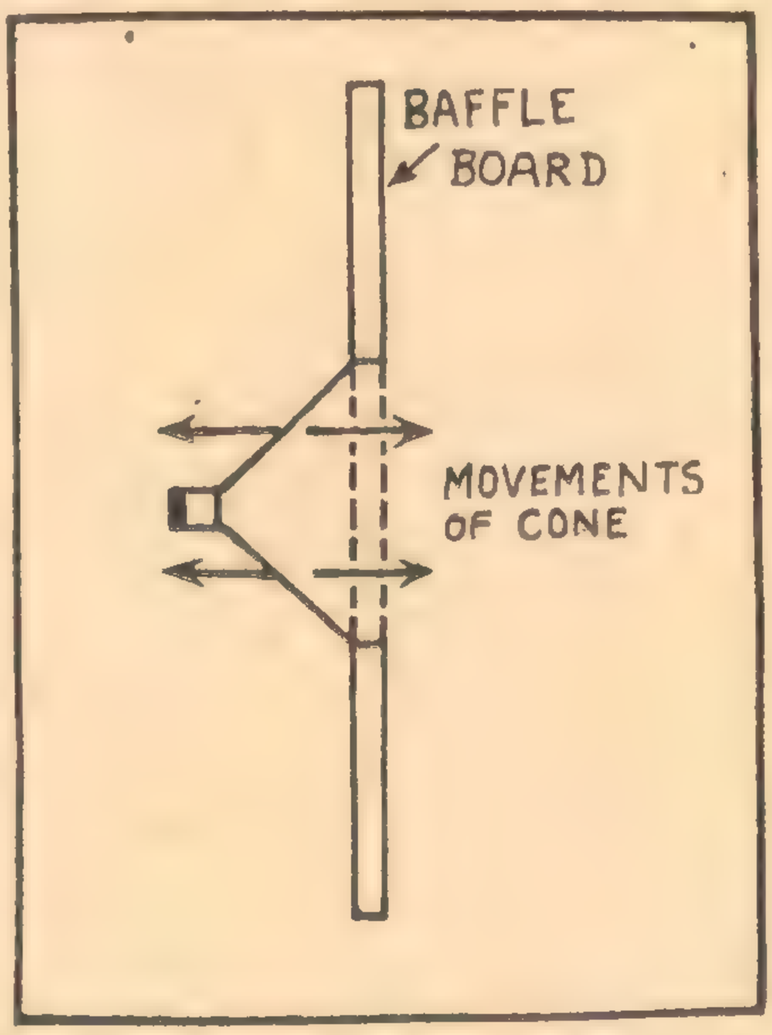


Figure 2. For proper tonal balance, a dynamic loudspeaker must be mounted on a baffle board, the hole in the baffle corresponding with the size of the cone. Within reason, the larger the baffle, the better.

FIELD RESISTANCE

The actual field resistance chosen depends on the circuit arrangement of the receiver or amplifier. If a larger amount of current has to flow through the field coil, the resistance of the coil must be reduced so that the voltage drop is only sufficient to produce the required field wattage.

When a high voltage is applied to the field coil, a high resistance is used, so that only a small current is able to flow, and this keeps the field wattage down to a satisfactory level.

Fig. 3 shows one of the most common ways of energising the speaker field in a mains-operated receiver. The field in this case acts as a filter choke for the receiver. Its d-c resistance would probably be about 2000 ohms, and it would normally have a voltage drop across it of approximately 150 volts.

OUTPUT TRANSFORMER

The voice coil consists of comparatively few turns and, consequently, has little impedance. Therefore, it would not operate efficiently if connected directly in the plate circuit of the power tube. Also, it would be unsatisfactory to have d-c plate current flowing in this coil, as it would give it a definite polarity, causing the coil to move permanently in or out, and not stay centred by its mechanical suspension.

A special transformer is used to couple

(Continued on Page 51)

WORK OUT YOUR OWN MATHS PROBLEMS

As we completed in last month's issue the discussion of the more important calculations associated with direct current, the next logical step will be to pass on to alternating current circuits. However, due to the more complex nature of these circuits, and in order that the reader may more readily understand them, we propose first of all to devote some space to a review of elementary mathematics.

by C. E. Birchmeier

WHILST, no doubt, the majority of our readers were once quite familiar with the usual simple mathematical terms and operations, it is true that such things are very easily forgotten, unless they are continually met with in our everyday work.

To overcome this difficulty, we plan to go over those sections of arithmetic, algebra, trigonometry, &c., which are likely to have been forgotten and which will be so essential for the understanding of the articles to follow.

The discussion will probably be too brief and sketchy for those who have never done the work in the first place. To such, we would suggest that they buy one of the many small textbooks on elementary mathematics and study the various items for themselves.

REVISION NECESSARY

Without a knowledge of these subjects it is practically impossible to grasp properly the basic ideas of certain electrical phenomena. While the points we intend discussing may be understood by many readers and to them appear a waste of space, we must ask them to bear with us and realise there are many not quite so fortunate.

In general, arithmetic consists of operations involving addition, subtraction, multiplication and division, and we are assuming you understand the various functions of these signs—at least as far as whole numbers are concerned.

However, as regards fractional quantities, it is possible a few may be hazy on their solution and, as they are frequently met when dealing with resistances in parallel or capacitances in series, we will start off by discussing them.

As the name implies, a fraction is a part of a whole number or unit. The lower number of a fraction is called the denominator and shows into how many parts the whole number is divided. The top number, known as the numerator, tells us how many of the said parts are to be taken.

The addition or subtraction of like fractions is quite simple, the sum being obtained by adding the numerators or subtracting as the case may be.

$$\frac{3}{8} + \frac{5}{8} = \frac{8}{8} = 1$$

$$\text{or} \quad \frac{7}{8} - \frac{4}{8} = \frac{3}{8}$$

But now suppose you had to add ½, ¾ and ⅞ together! Could you do it? In a case like this it is necessary to convert all the fractions to have the same denominator. This is done by bringing them to a common denominator, known as the least common multiple or LCM. The LCM is the smallest number divisible equally by the denominator of each fraction.

In the example shown, it will be apparent that the smallest number divisible by each denominator is 8, so we convert each fraction to eighths. Thus ½ equals 4/8, ¾ equals 6/8, which, added to ⅞, gives us 17/8. Now since 8/8 is the same as 1, 17/8 can also be expressed as $2\frac{1}{8}$.

So now in future, whenever you have to add or subtract unlike fractions, first of all determine the least common multiple of the denominators, convert the fractions and then proceed with the addition or subtraction of the numerators as the signs indicate.

MULTIPLICATION, DIVISION

The multiplication of fractions involves the multiplying of the numerators and denominators respectively to obtain the resultant fraction. For example:—

$$\frac{5}{8} \times \frac{3}{4} = \frac{5 \times 3}{8 \times 4} = \frac{15}{32}$$

If there are whole numbers as well as fractional quantities to consider, then the first step is to reduce the mixed numbers to a single fraction, thus:—

$$2\frac{3}{8} \times 1\frac{7}{8} = \frac{19 \times 15}{8 \times 8}$$

$$= \frac{285}{64} = 4\frac{29}{64}$$

Now in dividing one fraction by another, simply invert (that is, interchange the numerator and denominator) of the divisor and multiply, so:—

$$\frac{5}{8} \div \frac{3}{4} = \frac{5}{8} \times \frac{4}{3} = \frac{20}{24}$$

$$\text{which cancels to} \quad \frac{5}{6}$$

You will notice that we simplified our answer by cancelling. Whenever the numerator and denominator of a fraction are divisible by the same number, they may both be divided by that number. Thus, in the case of the fraction 20/24, both the numerator and the denominator were divisible by 4, the fraction becoming 5/6. The numerator and denominator cannot be divided independently. What we do to the one we must do to the other; otherwise the value of the fraction would be altered.

Another point is in regard to whole numbers. These can always be expressed as fractions by supplying a denominator of 1, thus 7/1 is the same as 7; 10/1 is the same as 10, and so on. By this means it is often possible to simplify calculations involving whole numbers and fractions.

MATHS SIGNS AT A GLANCE:

+ Added to.	$\sqrt{\ }$ Square root of.
− Subtract	$\sqrt[3]{\ }$ Cube root of
× Multiplied by.	= Is equal to.
÷ Divided by.	≒ Is approx. equal to.

Fractions may be shown in any one of the following ways, according to the printing facilities available. The first method is preferable in that it avoids likelihood of confusion when the fraction is associated with whole numbers

$\frac{3}{4}$ $\quad$ 3/4 $\quad$ 3/4

A small figure above and to the right of a number indicates that that number is to be squared, cubed, raised to the fourth or fifth power, and so on, according to the number concerned

3^2, 3^3, 3^4, 3^5, . . . etc.

ABOUT DECIMALS

For convenience, fractions are often expressed as decimals. Decimals are, unfortunately, rather hard to explain in a limited space, yet they are very easy to use once you grasp the idea of them.

The number 10 is the key to our numbering system. Count from 1 to 9 and nothing interesting happens. You merely introduce a new word or symbol to represent a particular number or unit. However, when you reach 10, you have to represent it by two symbols, placed side by side, thus: 10.

Then, to write down all the numbers 11 to 19, you maintain the figure 1 on the left and simply use again the original list of symbols 1 to 9. When you reach twenty, the number on the left changes from 1 to 2, indicating that there are now two lots of 10 (i.e., 20) associated with the number in the right-hand position, be that number 0, 1 or any other number up to 9.

THREE, FOUR FIGURES

So the process continues until, after 99, we come to a three-figure symbol. The figure in the left-hand column indicates the number of hundreds, that in the centre column the number of tens, and that in the right-hand columun the number of units. So the figures continue to build up on the left-hand side, with figures indicating tens of thousands, hundreds of thousands, millions, tens of millions and so on.

Decimals are simply the same process in reverse. Although it is not usually done, we would be quite correct in putting a decimal point just to the right of every complete whole number, thus: 1. or 13. or 45. or 276. and so on. However, when we are only dealing in whole numbers, it would be a nuisance to have to keep writing down decimal points.

However, the space to the right of a decimal point is used to indicate fractions less than a complete unit. Thus, a figure on the immediate right of a decimal point indicates a number of tenths. In other words, the symbol 1.1 indicates a complete unit plus one-tenth of a unit. The symbol .4 simply means four-tenths of a unit.

POSITION SIGNIFICANT

As the figures move place for place to the right of the decimal point, they progressively denote smaller fractions: tenths, hundreds, thousandths and so on. Thus the symbol .234 means two-tenths plus three-hundredths plus four-thousandths—or, more simply, 234-thousandths of a complete unit.

When writing down decimals having no associated whole number, it is as well to add 0 to the left of the decimal point, so that the point will not be overlooked. Thus .1 is better written as 0.1, the 0 emphasising the presence of the decimal point.

Remember that the order of a number is indicated by its position relative to the decimal point. Thus one-thousandth part of a unit is shown as .001, the two zeros indicating that there are no tenths and no hundredths.

Now it is quite easy to convert fractions to decimals if they are already in tenths or hundredths, &c. But what of such fractions as ⅝, where the denominator has no simple relationship to 10? Fortunately, the conversion only involves arithmetical division.

The conversion to a decimal simply involves dividing the denominator into the numerator, that is, dividing 8 into 3. As the fraction is less than one, all the figures must lie to the right of the decimal point.

Of course, 8 will not divide into 3. But do not be deterred. Simply put down a decimal point, add 0 to the right of the 3 and try again. This time it is 8 into 30, which goes 3 times with a remainder of 6. Now add another 0 to the remainder, which becomes 60 and divide that by 8. The answer is 7 times with 4 over. Repeat the process, adding 0 to the 4. This time the answer is 5 and there is no remainder.

Therefore the fraction ⅝ is equal to the decimal 0.375. Had the fraction been 3/80, it would not have divided after the addition of the first 0 and you would have to have added another 0 both to the 3 and to the decimal, the final answer being 0.0375.

COMPLICATED FRACTIONS

A complicated fraction such as 21/28 is treated just the same way, only you would have to use long division. If you cannot get the division to come out without a remainder, the process can be terminated and the answer given as correct to so many decimal places.

Thus an answer may reach 0.123456 without termination. In this case, it could be quoted as 0.12346, correct to five places. In other words, you carry the process of division one place further than is actually required. If the last figure is five or more, then 1 is added to the preceding number. Thus 0.12345 correct to four places would be 0.1235. The figure 0.12344 correct to four places would be 0.1234, the last figure simply being dropped off, as it is less than 5.

The addition and subtraction of decimals is done in exactly the same way as ordinary arithmetic, except that care must be taken to have the various decimal points aligned vertically. For example, suppose we wish to add 25.97, 0.083 and 11.006, the procedure is as follows:—

```
 25.97
  0.083
 11.006
 37.059
```

Similarly, with subtraction the same procedure is followed. For example, suppose 23.769 is to be subtracted from 347.983, we have:—

```
347.983 -
 23.769
324.214
```

Now, when multiplying decimals, treat the numbers as whole numbers and leave the placing of the decimal point until all the multiplication is completed. Then the decimal point is placed in the product so that the number of decimal places will be equal to the sum of the decimal places in the two original numbers. An example will make this statement clear:—

```
 43.62 x
  2.15
 21810
 4362
 8724
937830
```

Now there are two decimal places in the first number and two in the second—a total of four. So from the right-hand side of the answer count off four places and this is the position for the decimal point. Thus we obtain 93.7830.

In multiplying decimals by 10, 100 or 1000, the decimal point is moved one, two or three places respectively to the right, as the case may be. For instance, multiply 7.5 by 10. Here the decimal point is moved one position to the right and so 75 is obtained. Similarly, the converse holds good in dividing by 10, that is, the decimal point is moved to the left. Divide 705.4 by 100. From the above rule we move the decimal point two places to the left and thus obtain 7.054.

To divide a decimal by a whole number other than 10, you simply proceed

(Continued on Page 54)

TRY YOUR HAND AT THESE:

1. Add the following: 8/3, 24/5, 15/4, 35/6, 48/7.
   Also: 5/18, 7/45, 57/25, 97/30.
2. 11—3¾; 17—4¼; 7⅜—3⅝.
3. Multiply ⅜ by ¼; 8/27 by 3/16.
4. Divide ¾ by 7; 2/3 by 5; 48/53 by 15.
5. Add 63.5435, 21.207, 19.5, .000835, 357, and 9.0625.
6. By how much does the sum of 34.2375 and 16.0007 exceed the sum of 13.9324 and 15.9874?
7. Multiply 270.26 by .00025; 1.0005 by 0.097; 11.687 by 0.45.
8. Divide 4.73 by 1.1; 53 by .0025; 8404.99599 by 834.657.
9. Find the square root of 452929, 574560900, 207936.

ANSWERS TO MATHS. PROBLEMS

1. $23\frac{127}{140}$, $5\frac{71}{75}$
2. 7¼, 12¼, 3¾.
3. 3/32, 1/18.
4. 3/28, 2/15, 16/265.
5. 470.313835.
6. 20.3184.
7. .067565, .097485, 5.25915.
8. 4.3, 21200, 10.07.
9. 673, 23970, 456.

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BATTERY OPERATED S.W. CONVERTERS

Last month, in response to many requests, we published an article on short-wave converters for a-c operation. Already we have heard from quite a number of our readers, who were obviously waiting for the particular information. It now seems the logical thing to devote some space to short-wave converters for battery operation.

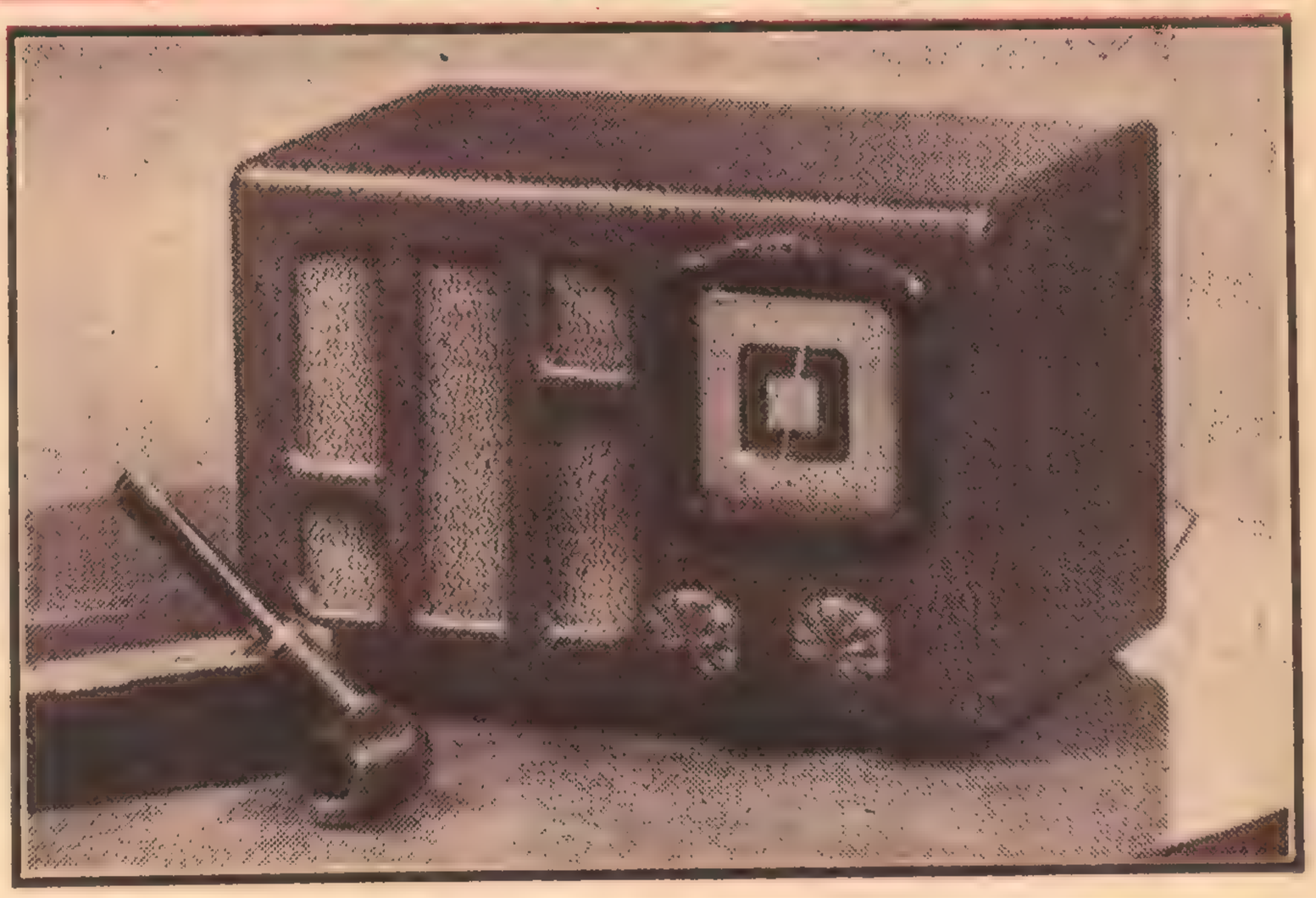

Figure 1. As we suggested last month, a short-wave converter can be made quite attractive in appearance by housing it in a cabinet designed for the "Little General" receiver. These cabinets are readily available at moderate cost and finished in a variety of colors. One with two holes is most suitable for battery operated converters.

BY way of introduction we sought last month to explain in some considerable detail just how a short-wave converter operates. Although we propose to repeat the explanation very briefly it would be as well for those of our country readers who are interested to read through the earlier article.

As regards the principle of operation, a short-wave "converter" is quite different to the once popular short-wave "adaptor."

The usual short-wave adaptor was simply a regenerative detector unit, which could be plugged into the detector socket of an old TRF receiver. The short-wave signals were tuned in on the detector unit and amplified by the audio stages of the broadcast receiver. Only the audio stages of the broadcast receiver were used, the r-f amplifiers, if any, remaining idle.

THE PRINCIPLES

A short-wave converter, on the other hand, is a device which goes ahead of the broadcast receiver. In fact, the aerial has to be disconnected from the aerial terminal of the receiver and connected to the aerial terminal of the converter. Another lead from the converter connects to the receiver aerial terminal.

The converter contains an oscillator, which generates voltages at a very high frequency, dependant on the adjustment of the associated tuned circuit. The electrical circuit is such that these locally generated voltages are mixed with the signal voltages fed in from the aerial and "beat" or "heterodyne" signals are produced at frequencies quite distinct from either of the original frequencies.

It is possible to arrange matters so that the "beat" frequency, which represents the difference between the desired short-wave signals and the frequency of the oscillator, falls within the tuning range of the broadcast receiver. This "beat" or "heterodyne" signal bears the modulation of the original short-wave carrier and the signals are heard in the broadcast receiver, in just the same way as any other modulated carrier on the broadcast band.

TYPICAL FIGURES

The general idea, therefore, is to connect the converter in series with the receiver aerial lead. The receiver is then tuned to a spot in the broadcast band, where there are no audible signals. For the sake of argument, this spot may be at 600 Kc/s.

Next, the dial of the short-wave converter is rotated. In a typical case, rotating the converter dial through the extremes of its range may change the frequency of the local oscillations from 24 to 7 Mc/s, or from 24,000 to 7000 Kc/s.

by W. N. Williams

On each occasion that the frequency of the local oscillator differs from that of a short-wave station by 600 Kc/s, a beat signal is produced at that frequency (600 Kc/s) and is heard as an audible signal from the broadcast receiver.

For example, there may be a short-wave station broadcasting on exactly 20 metres; i.e., 15 Mc/s or 15,000 Kc/s. When the frequency of the local oscillator happened to be 14,400 or 15,600 Kc/s, a beat would be produced at 600 Kc/s, and would be audible in the broadcast receiver, just as if the station were actually transmitting on 600 Kc/s.

To express it in everyday terms, by combining the short-wave signal with a locally produced oscillation, we succeed in "manufacturing" a new signal at a frequency within the tuning range of the broadcast receiver.

You may have noticed that we mentioned two particular frequencies for the local oscillator—and, therefore, two particular settings of the converter dial—at which the desired beat frequency is produced with the same short-wave signal. Therein lies the explanation of "double-spotting" or "image reception," which is very often characteristic of short-wave superheterodyne receivers.

PRE-SELECTION

The way to limit or obviate double-spotting is to have one or more tuned circuits ahead of the "mixer" stage, so that signals to one side or the other of the oscillator frequency are favored, and those on the other side are excluded.

This is an important point. Try and keep it in mind and we will have more to say about it at a later juncture.

It must be realised, of course, that with a multiplicity of signals reaching the converter from the aerial, there are all kinds of beat frequencies in the output. However, the only one heard is that which happens to correspond to the frequency to which the broadcast receiver is tuned.

CONSTRUCTION

SHORT-WAVE CONVERTER FOR R.C.S. COILS

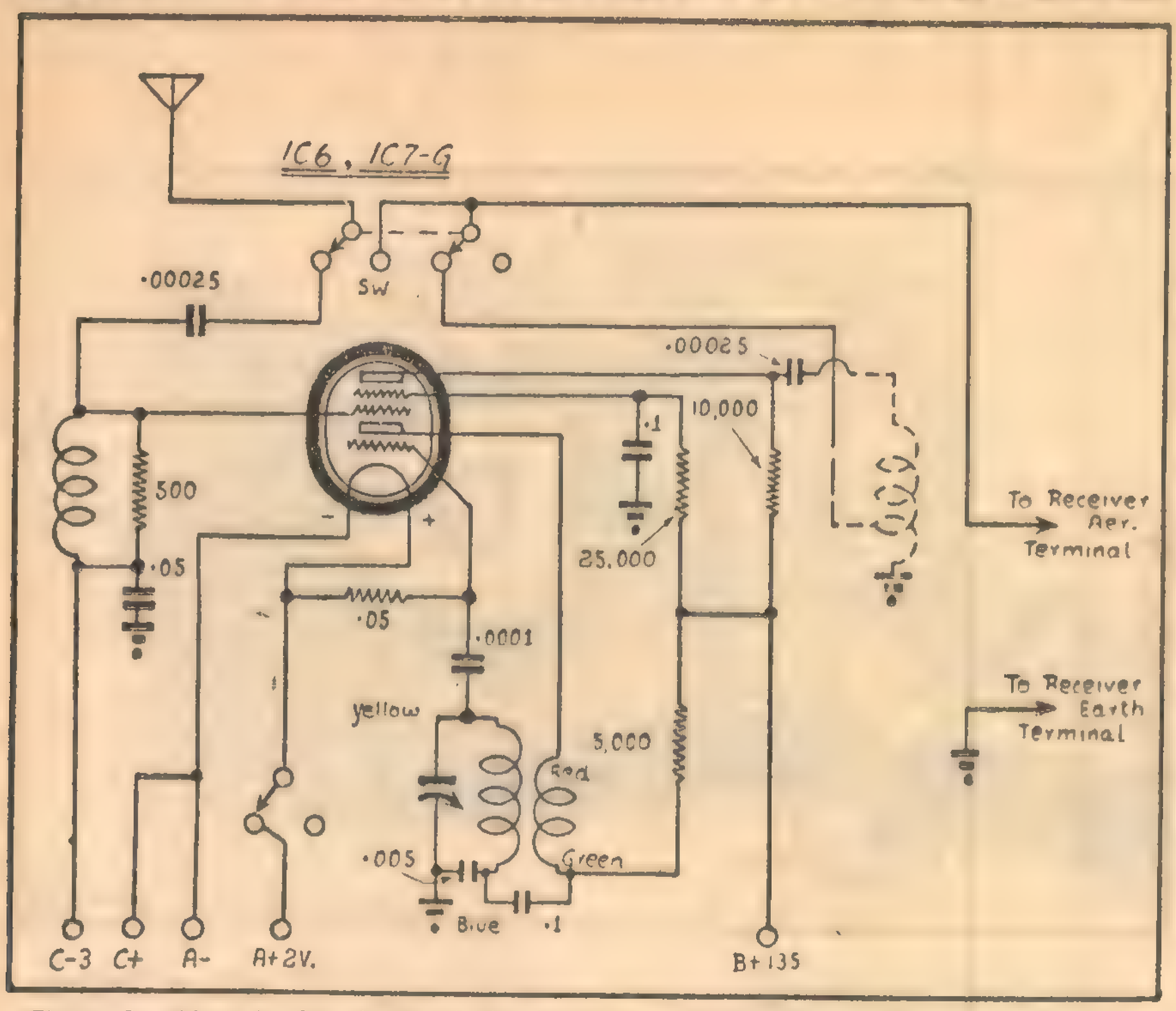

Figure 2. Here is the circuit of the battery-operated short-wave converter built up around the R.C.S. coil kit. It is extremely simple, uses a single-gang tuning condenser and requires no adjustments after completion. The BC/SW changeover switch is a single-bank 3 x 3 unit. Only two positions are used, the third being left blank. One pole of the switch is wired to break the filament circuit when the converter is not in use.

We mentioned a frequency of 600 Kc/s. However, that was only by way of example. The same would be true of any other frequency setting within the tuning range of the broadcast receiver.

It will be apparent, that, with this system of reception, the whole of the gain of the broadcast receiver is utilised. Thus, a short-wave converter, used in conjunction with a receiver capable of reasonable interstate reception, will bring in stations from all over the world.

As we explained in the previous article on the subject, there is not much point in trying to use a converter with very small one and two valve receivers. The set-up may function in a fashion, but its usefulness will be very limited.

OSCILLATOR AND MIXER

The converter itself must contain an oscillator and a so-called "mixer" stage. Some years ago separate valves were used for these two functions, but present practice is to use a single converter valve, or frequency changer, having a complex structure of electrodes and combining the two functions within the one envelope.

Such valves are primarily intended for use in superheterodyne receivers, but they come in quite nicely for short-wave converters. Actually, the principle is the same in either application.

Thus it is that a short-wave converter offers a very simple and easy way out to the person who has a good broadcast receiver and who is interested in short-wave reception. Properly installed and handled, a short-wave converter will make available quite a lot of entertainment on the short waves.

For the listener with a mains receiver, the story would probably end there—apart from the actual construction. For the owner of a battery set, as is so often the case, there is a bitter pill to swallow.

HIGH TENSION DRAIN

A short-wave converter using a conventional valve such as the 1C6 or 1C7-G, requires a high-tension supply of 135 volts and a current of about 7.0 milliamps. This drain, added to the existing drain of the receiver, may represent a figure of 15 or 20 milliamps.

This may alarm quite a few readers and induce them to put aside the whole idea, once and for all. However, that is the position and there is no point in evading it.

One of these days we may be able to get down to the design of a really economical short-wave converter, but time is against us at the moment. If, in the meantime, you build up one of the converters detailed here, don't use it for longer periods than necessary.

It is quite likely that using the converter for short periods would not affect the life of the B batteries to any great extent.

You may be able to lighten the load on the B batteries by using less than the full high tension voltage on the main receiver, or by increasing the bias voltages, while the converter is in operation. For short-wave reception, one is seldom worried about obtaining the utmost fidelity of reproduction.

BATTERY CONNECTIONS

Another possibility is to provide an extra set of B batteries, especially for the converter. However, under the present circumstances, few will be able to do this. One is rather fortunate to have batteries for the receiver, let alone a separate set for auxiliary apparatus.

In most battery receivers, B-minus and A-minus are connected directly to the chassis. However, this is not an invariable rule. Some receivers have switching in either one or both of the negative leads; some have back-bias resistors in series B-minus and the chassis. In a few receivers, A-plus and not A-minus is returned to the chassis.

When we first wired up the converters we simply connected A-minus and B-minus directly to the chassis. In fact, the converters were wired in this fashion when the underneath photographs were taken.

DANGER OF SHORTS

However, a little quiet thought showed that this method of connection might not be satisfactory in all cases. If the broadcast receiver happened to be one in which A-minus and B-minus were not connected direct to chassis, and if the converter were connected up to the same set of batteries, there was a good chance of shorting out the A battery of perhaps some of the switching and back-bias arrangements in the receiver.

Assuming that all readers would not be able to check up on the internal connections of the broadcast receiver, the question was how to arrange mat-

(Continued on Page 36)

CONNECTIONS FOR THE R.C.S. COIL KIT

AERIAL COIL: Has two connections only. It is immaterial which way the coil is connected into circuit.

RESISTOR: Is a standard 500-ohm wire-wound unit, to be connected directly across the terminals of the aerial coil.

OSCILLATOR COIL: Has four lugs, color-coded as follows: Yellow—through the .0001 mfd grid condenser to the oscillator grid. Blue—through the .005 mfd condenser to earth. Red—to the oscillator anode. Green—through the 5000 ohm resistor to B plus.

TAPPED OUTPUT CHOKE: Has three connections, as follows: The mounting screw and the lug connecting to it should be earthed. The lug connecting to the outside of the winding goes to plate, through the coupling condenser. The lug connected to the tapping is for connection to the receiver aerial terminal. Note that this choke is primarily intended for use where the broadcast receiver has a low impedance aerial coil.

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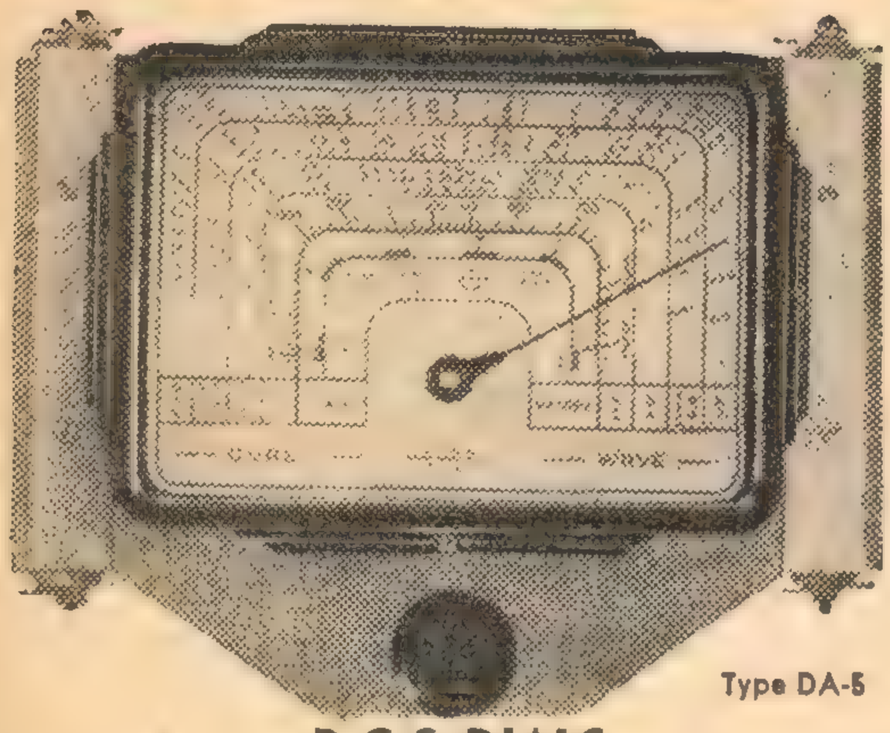

Type DA-5

R-C-S DIALS

Types DA-1 and DA-2 are single glass dual-wave, the type DA-2 having been designed especially for use with the Five-Band Communications Coil Kit and "H" type condenser. Type DA-1 is a standard dual-wave dial for use with R.C.S. coils and "F" type condenser. The DA-5 dial is for use on the 1600 to 550 k.c. and 13.7 to 40 metre bands, with "H" type condenser. All this series is edge-lit and wedge-driven. Aperture for the escutcheon is approximately 7in. x 4⅞in.

DA-1 Standard D/W Dial, "F" condenser 22/6
DA-2 Communication Dial 22/6
DA-5, 13.7 to 40 metres D/W Dial, "H" condenser 22/6
DA-6 Mantel Set Dial, D/W "H" gang 18/9
DA-7 Portable Kit Dial, D/W "H" gang 9/-
DA-8 Same as DA-7, but ready assembled 13/6

DA-9 DIAL

The new R.C.S. Kit Dial has 0-100 scale. This is an excellent replacement dial. All parts supplied ready to assemble, and suitable for crystal and small T.R.F. sets. The special walnut escutcheon is easy to fit, and requires an aperature of 3in. by 3in. It is the only portable dial which can be edge-lit.
Code DA-9. Price 9/-

R-C-S-D-W UNIT

Code DW36

Type DW36, as illustrated, consists of Aerial and Oscillator Coils, Wave Change Switch, the necessary B.C. and S.W. Trimmers and Padder mounted together, wired up ready to assemble into a set utilising 465 k.c., the bands being S.W., 13.7 to 40 metres, and B.C. 1600 to 550 k.c.
Code DW36 ... ... £1/7/6

You can buy R.C.S. Products only through these distributors:

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ADELAIDE: Gerard & Goodman—A. G. Healing—Newton, Mclaren, Ltd.
BRISBANE: Chandler's; Trackson's; Homecrafts.
TASMANIA: W. & G. Genders, Launceston—W. & G. Genders, Hobart—W. & G. Genders, Burnie.
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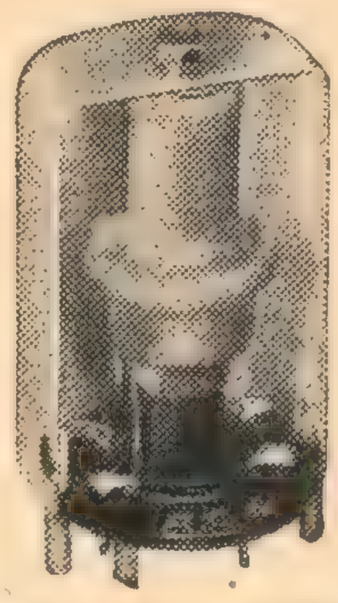

R-C-S TROLITUL B-C COILS

These coils are available in both Air Core and Permeability-tuned types. The latter are adjusted to ensure maximum efficiency in our laboratories.

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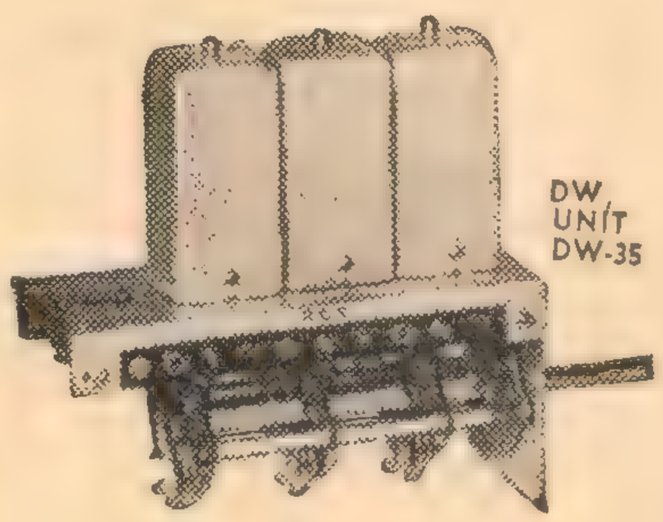
E343 R.F. 6/6
E344 Osc. 6/6
PERM. TUNED "H" GANG
E345 Aerial 8/6
E346 R.F. 8/6
E347 Osc. 8/6
T.R.F. TYPE "H" GANG AIR CORE
T88 Aerial 6/6
T89 R.F. 6/6
T87 R.F. with reaction .. 6/6



R-C-S DUAL WAVE UNIT

Type DW-35, as illustrated, consists of Aerial, R.F. and Oscillator Coils, Wave Change Switch, the necessary B/C and S/W Trimmers and Padder mounted on a rigid steel base, wired up ready to assemble in a set utilising 465 k.c. and R.F. Stage. The Bands are S/W 13.7 to 40 metres, and B/C 1600 to 550 k.c.
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When two I.F.'s are used:
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IF163 .. .. .. 13/9
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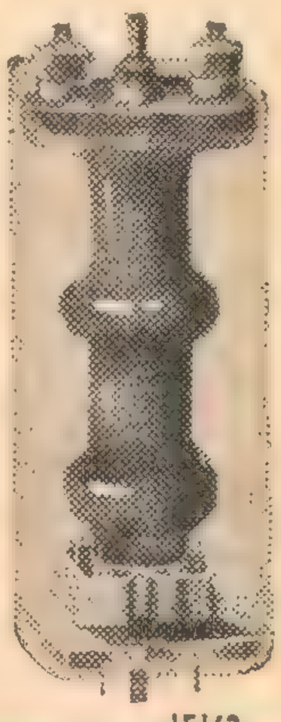
IF163 .. .. .. 13/9
IF166, 1st I.F. .. 7/6
IF167, 2nd I.F. . 7/6

Air Core 175 K.C.
IE68, 1st I.F. . 7/6
IE69, 2nd I.F. . 7/6



IF162

CONSTRUCTION

UNDERNEATH WIRING DIAGRAM—R.C.S. COILS

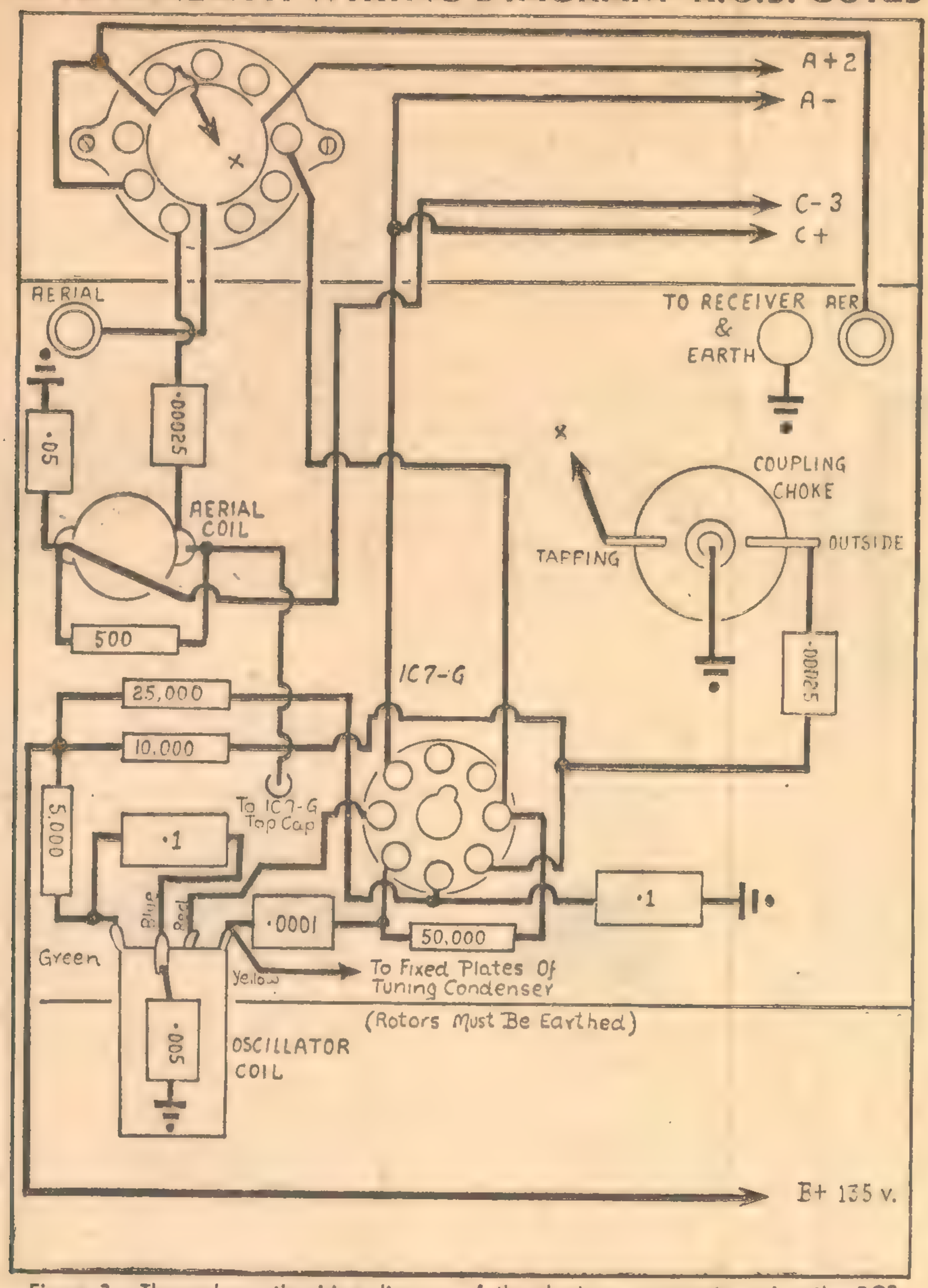


Figure 3. The underneath wiring diagram of the short-wave converter using the RCS coil kit. There are three terminals, one for the aerial connection and two others connecting respectively to the aerial and earth connection of the receiver. There are also five battery leads, which can either be taken out direct or wired to a battery outlet socket and plug.

ters to obviate possibility of shorting anything when the converter was connected up.

To begin with, it is desirable for the chassis of the converter to be at the same potential as that of the main receiver. Therefore, it has to be taken for granted that the two chasses are to be interconnected, and that this interconnection will provide the negative path for the high tension supply.

Of course, this means that the drain on the converter will upset the bias across any back-bias system which happens to be incorporated in the receiver, but this may be a blessing in disguise, since the effect will be to reduce the total B battery drain. The performance of the receiver may suffer when the converter is in operation, but it is unlikely that it will not be good enough for the purpose.

With this arrangement, B-minu must not be bonded to the chassis o the converter in any way. The onl time when it would be necessary to con nect the B-minus lead to the converte chassis would be if a separate set of batteries were used for the converter supply.

It can be taken for granted that th A battery will be connected to the batteries within the main receiver, al though the manner of connection i open to doubt. To avoid chances o short-circuiting anything, you will not that we have omitted altogether an connection between the filament wirin and the chassis of the converter.

FILAMENT SUPPLY

As we explained earlier, such a connection may be apparent in the underneath photographs, but these were taken before we changed over the wiring. If you decide to use a separate A battery for the converter—although there is scarcely any reason for so doing—then A-minus may be connected to the chassis.

The converter requires a filament voltage of 2.0 volts. If your A battery delivers a higher voltage than this, it will be necessary to tap the filament supply from a single cell, preferably at the negative end of the battery.

With the A and B battery wiring arranged as we have outlined, and both isolated from the chassis of the converter, there is not much chance of things going wrong. It will not matter a great deal to the converter just how the batteries are interconnected within the main receiver.

C BIAS BATTERY

The final consideration is in regard to the C battery. Here again, the usual thing is to connect C-plus to the chassis of the receiver, but there is no guarantee that this is always done, and connection of both converter and receiver to the C battery may possibly lead to a short-circuit somewhere.

To avoid this possibility, we suggest that you use an entirely separate C battery for the converter. C batteries are quite cheap and last a long time, and there is no great hardship in duplicating one. The circuit shows the C battery connected between the grid circuit and A-minus, and quite independent of the chassis. Irrespective of how the A

PARTS LIST FOR THE R.C.S. CONVERTER

1 small chassis to suit.
1 single-gang variable condenser, .004 mfd.
1 Vernial dial to suit.
1 3 x 3 single-bank wave-change switch.
1 R.C.S. aerial coil unit.
1 R.C.S. oscillator coil.
1 R.C.S. tapped coupling coil (if required).
1 10,000 ohm resistor, 1 watt.
1 25,000 ohm resistor, 1 watt.
1 50,000 ohm resistor, 1 watt.
1 500 ohm resistor, W.W.
2 .1 mfd tubular condensers.
1 .05 mfd. tubular condenser.
1 .005 mfd mica condenser.
2 .00025 mfd. mica condenser.
1 .0001 mfd. mica condenser.
1 5000 ohm resistor, 1 watt.
1 octal valve socket, or 6-pin as required.
1 5-pin battery outlet socket and plug (if required).

VALVE: 1 type 1C7-G, or 1C6.

Batteries: 1 2v. "A" battery, 3 45v. "B" batteries, 1 4.5v. "C" battery. (Converter will normallly be supplied by A and B batteries of the main receiver.)

SUNDRIES: 3 terminals, 2 knobs, 1 grid clip, hookup wire and shielded wire, nuts and bolts, solder, lugs, &c.

battery is connected in the main receiver, there will always be the necessary bias between A-minus and the control grid of the converter valve.

CHOICE OF VALVES

All this may sound rather involved, but it is not quite as bad as it might appear at first reading. If you follow the circuits exactly as shown, the chances are that the converter will operate quite happily as soon as it is switched on. If it does not do so, and you cannot puzzle out the reason why, the only thing to do would be to enlist the services of the local serviceman or of someone who has had a little more experience with such problems.

All this may not be very reassuring to the timid experimenter, but we must hasten to say that battery - operated converters really do pull in the overseas stations—despite the little problems which have to be faced.

Now let us get on to the discussion of the particular circuits.

The first consideration was in regard to the valves to be used. Assuming that modern converter valves were to be used, the choice lay between the 1.4-volt and the 2.0-volt.

At the moment, the 1.4-volt types are not nearly as plentiful as the 2.0-volt types. Though they are more economical as regards battery drain, they have the further disadvantage that they are not as robust and are more likely to fail prematurely. Still another objection is that the standard 1.4-volt converter, the 1A7-GT, is not a very good valve on the short-waves.

In view of these considerations, we decided to use the 2.0-volt variety and, in particular, the 1C7-G. The old-style equivalent, type 1C6, would serve just as well, if you happen to have one on hand.

The other 2.0-volt converter types, 1A6 and 1D7-G, are not very satisfactory for short-wave work, and we do not recommend their use.

SUPPLY VOLTAGES

Even the 1C6 and 1C7-G do not oscillate too readily, and a considerable amount of care is necessary in the design of the circuit to make sure that they do not fail when the batteries are getting low.

The filament voltage required by the 1C6 or 1C7-G is 2.0 volts. This can be tapped off a single cell of the accumulator. Be careful to see that it is a single cell! The drain is only 0.12 amp., which is of little consequence as far as the accumulator is concerned.

For the high-tension supply, a full 135 volts is desirable. If your receiver operates from only 90 volts, it will be necessary, for best results, to add another 45-volt battery for the converter The converter may operate in a fashion with a 90-volt supply, but the performance will probably be very poor and unreliable

Country readers may remember that we published three converter circuits last month, the first of which was a very simple arrangement, using a home-made coil and having resistive input and output circuits. This was published as much as anything as a matter of interest. It had a number of disadvantages, as we pointed out in the article.

Lack of space this month prevents us from again giving three alternative circuits, and we have omitted the very simple arrangement, concentrating on the two circuits using the commercial coil kits.

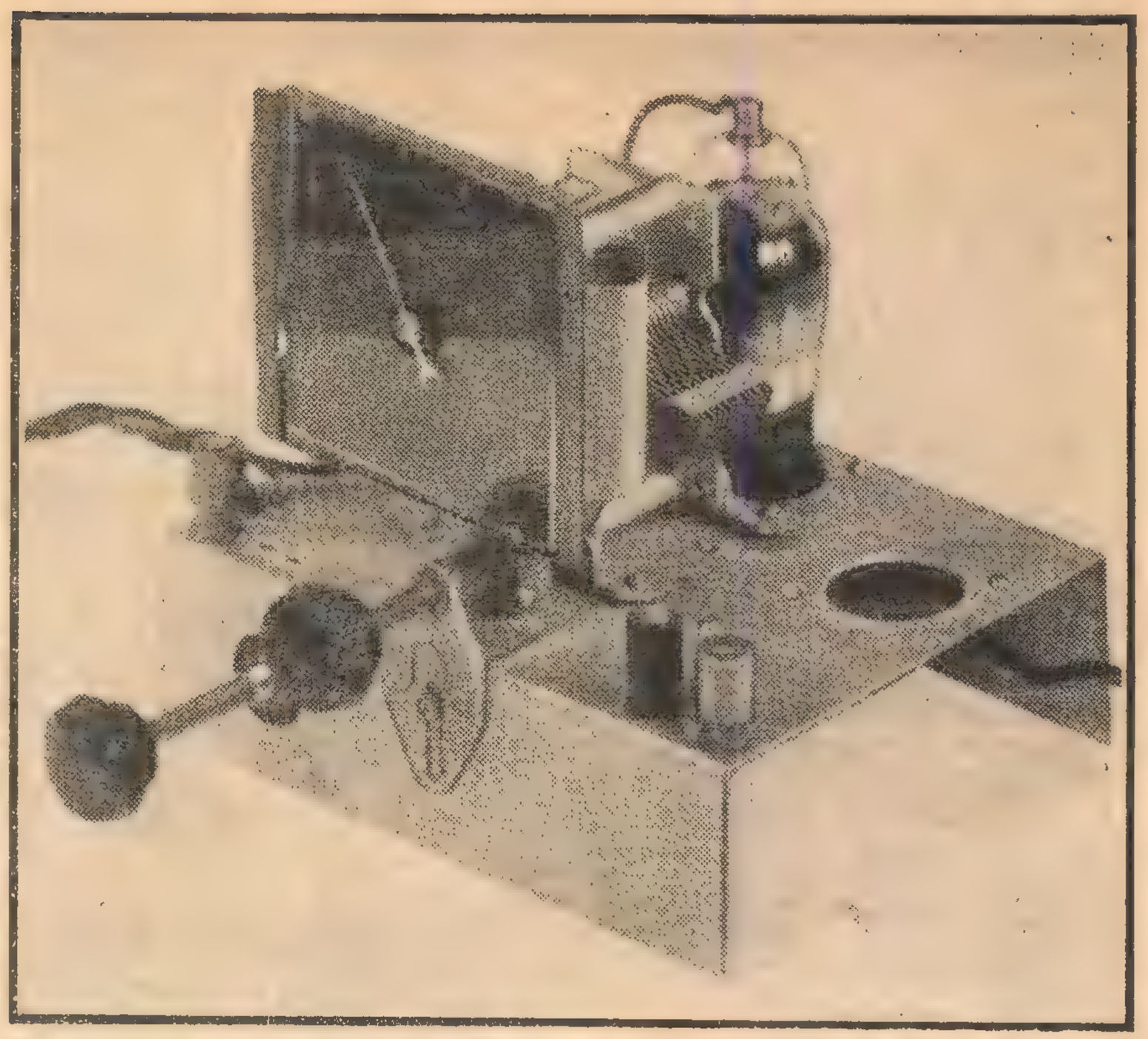


Figure 4. As you see, we built up the experimental model using the RCS coil kit on a small chassis which happened to suit our purpose. The terminal on the extreme left is for the aerial connection, those on the right for connection to the receiver.

COMMERCIAL COIL KITS

Of course, if you want to try out the simple circuit, there is no harm in doing so. You can follow the constants as given for the RCS converter circuit herewith, substituting a 10,000-ohm resistor for the special aerial coil unit and neglecting the tapped output choke.

The oscillator coil could be wound up to the specifications given last month, possibly adding another half-turn to the feedback winding.

There are two commercial short-wave converter coil kits available at the moment. They are quite different in their conception and construction, and require different circuits.

The simpler kit of the two is that made by "RCS." It requires only a single gang tuning condenser, and, once built, requires no adjustment.

The kit made by "Crown" is a more elaborate affair, which is capable of rather better results. However, it is more costly and requires to be adjusted after construction.

The constructor has to choose between cheapness and simplicity on the one hand and, on the other, better results at the expense of cost and complication.

The first circuit published herewith is the circuit built up around the RCS

(Continued on Next Page)

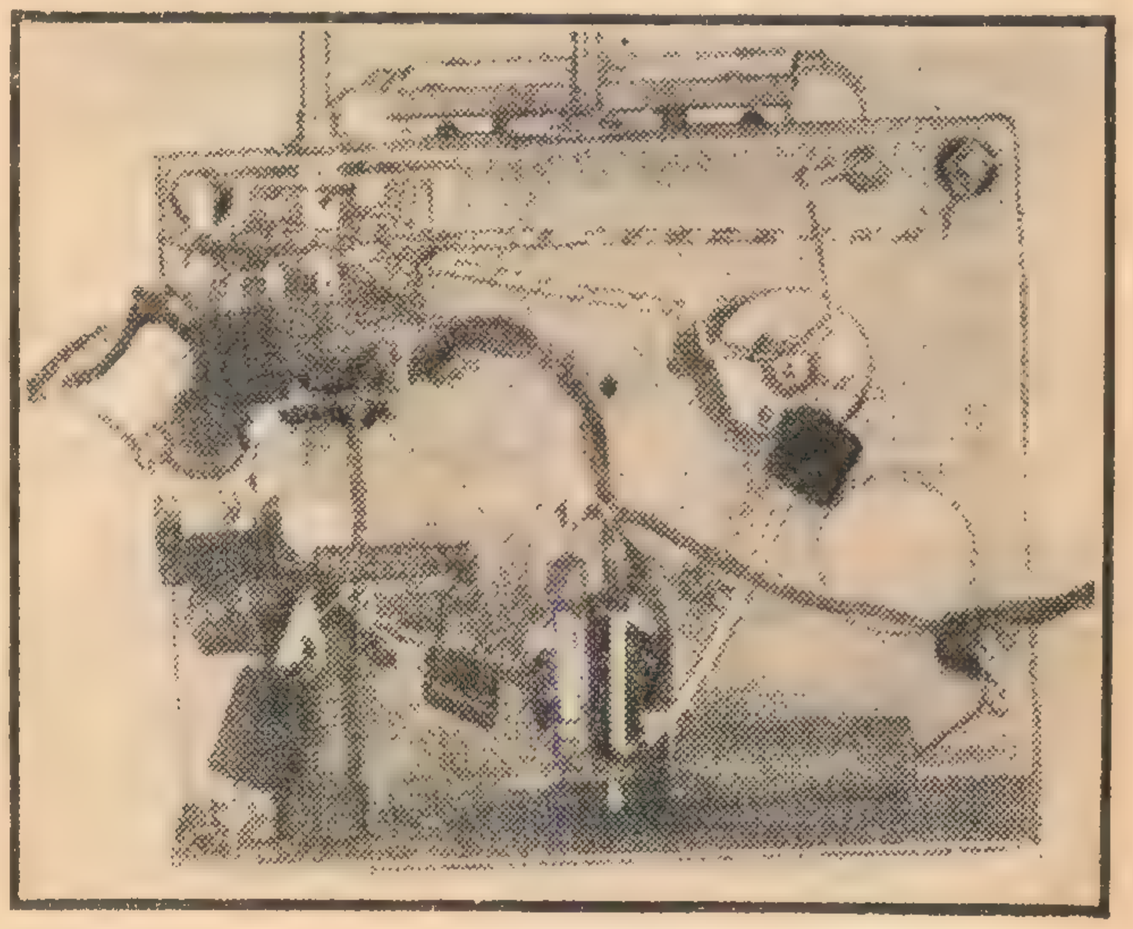


Figure 5. This picture gives a general idea of the layout of the parts beneath the chassis of the above converter. Note how the parts are grouped around the coil and socket to give the shortest possible leads. Subsequent to the photograph being taken we altered the wiring slightly to isolate the battery leads from the chassis. The amendments are included in the circuit and underneath wiring diagram

From Amateur to Sergeant of "Sigs"

Many of our friends who were enthusiastic set constructors in peace time are now serving with the colours "somewhere in Australia." To those of them who are reading these lines we send a hearty "cheerio and best wishes."

●

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SHORT-WAVE CONVERTER FOR CROWN COILS

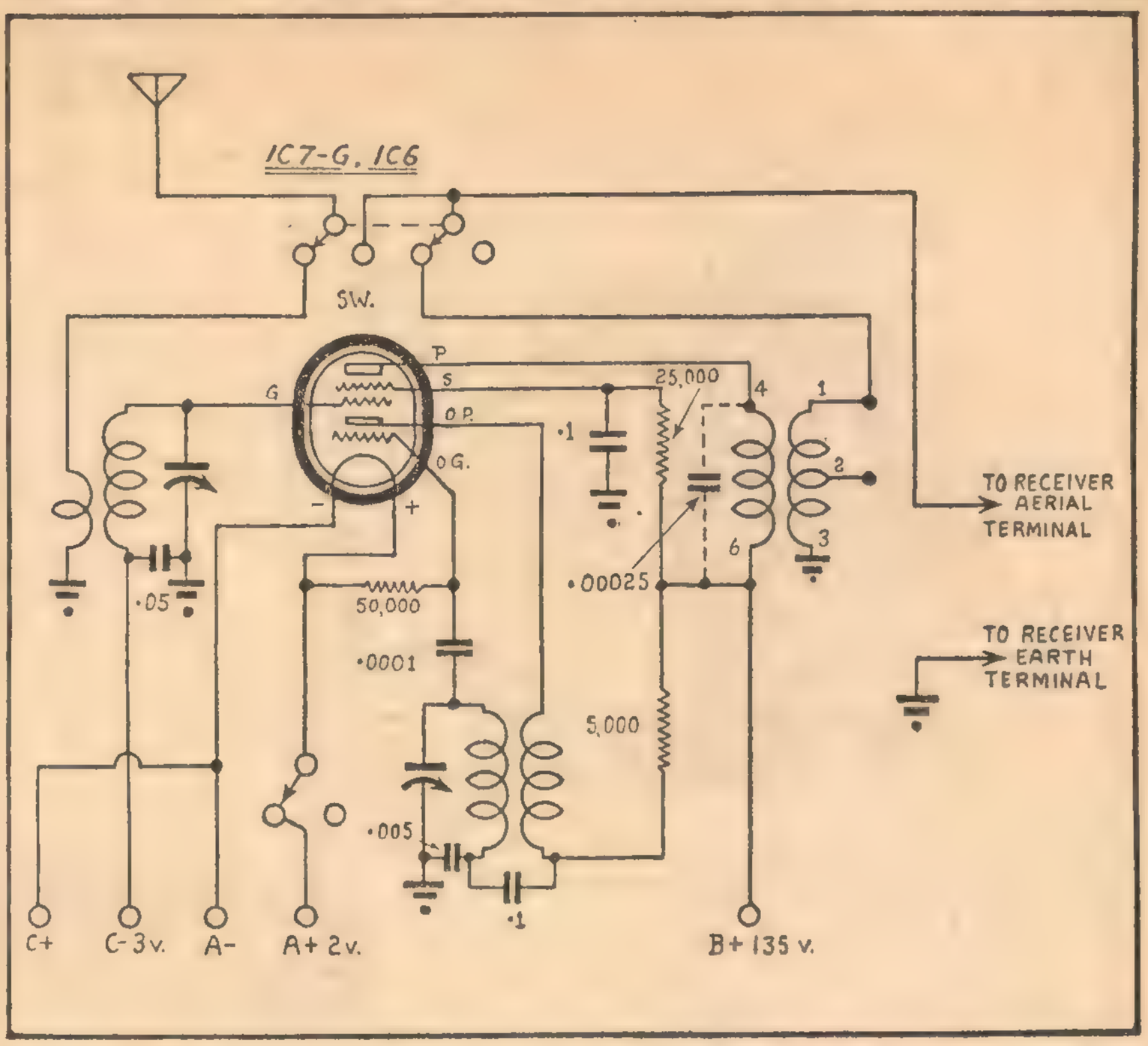

Figure 6. The second short-wave converter circuit, designed for the Crown coil kit. It has a tuned aerial circuit and requires the use of a two-gang tuning condenser. It also has a tuned plate circuit with a tapped output winding. One tapping is for feeding into low impedance aerial coils, the other for high impedance coils.

coil kit. The kit is exactly the same as used last month for the a-c operated converter. It comprises an aerial coil unit, a 500-ohm resistor, an oscillator coil, and a tapped output choke.

The oscillator coil is arranged to cover between about 15 and 40 metres, the exact coverage depending on the capacity range of the tuning condenser. Only a single gang tuning condenser is required for the RCS coil kit.

The tuning condenser should preferably be one of the modern types having a maximum capacitance of about .0004 mfd. However, one of the older types could be used equally well, provided it was in good mechanical condition and had a maximum capacitance of about .0004 mfd.

It will be found that the tuning is quite critical, and, for this reason, a vernier dial is essential. Once again, the actual type of dial is unimportant, provided that it has a smooth action and no backlash.

AERIAL COIL

The aerial coil of the RCS kit is of the untuned variety—or should we say that it is arranged to be broadly resonant within the desired short-wave band. This coil rejects, quite effectively, signals other than those in the desired short-wave band, and prevents strong broadcast stations coming through the converter circuits to the receiver.

However, it has no value in minimising image reception, or double-spotting, so that all short-wave signals are heard at two positions on the converter dial. This is rather confusing at first, but is really not troublesome, unless you are trying to decide accurately the frequency on which a certain station is transmitting.

CONNECTIONS FOR CROWN OUTPUT COIL

1. High impedance output tap.
2. Low impedance output tap.
3. Earth.
4. Plate.
5. No connection.
6. B-plus supply.

The output circuit of the converter is shown dotted. If the aerial coil of your broadcast receiver is of the high impedance type, there is really no need to use the tapped output choke. Quite efficient operation may be had by coupling the plate of the converter valve through the .00025mfd. condenser and the switching to the aerial terminal of the main receiver.

SEE AUGUST ISSUE

On the other hand, if the main receiver has a low impedance aerial coil, such a method of coupling is likely to be rather inefficient, and the use of the coupling choke is desirable. The necessary connections are shown dotted in the circuit diagram.

If you are not quite sure whether your receiver has a high or low impedance aerial coil, the best thing would be to use the coupling choke to be on the safe side.

All these points were discussed in considerably more detail in last month's article on the subject, and we suggest that you read through that, even though it had to do with a-c operated converters. This does not affect the discussion in regard to the coils.

When first the converter was wired up, the oscillator grid current was none too high, and we set about to find ways and means of pepping it up a little.

The usual method of feeding the oscillator anode of a 1C7-G is through a 20,000 ohm series resistor. Better oscillation may be had by omitting this altogether, although it has the effect of increasing the B battery drain. After a little experimenting, we found that we could materially improve the grid current by reducing the dropping resistor to 5000 ohms and adding padder feedback to help matters at the low frequency end of the band.

Another slight improvement was effected by increasing the oscillator grid condenser to .0001mfd. It had originally been .00005mfd. for the 6J8-G. By returning the .05meg. grid resistor to A-plus instead of the chassis, a further slight improvement was effected.

The precise effect of this latter measure is rather doubtful at the moment. It may be that the increase in grid cur-

(Continued on Next Page)

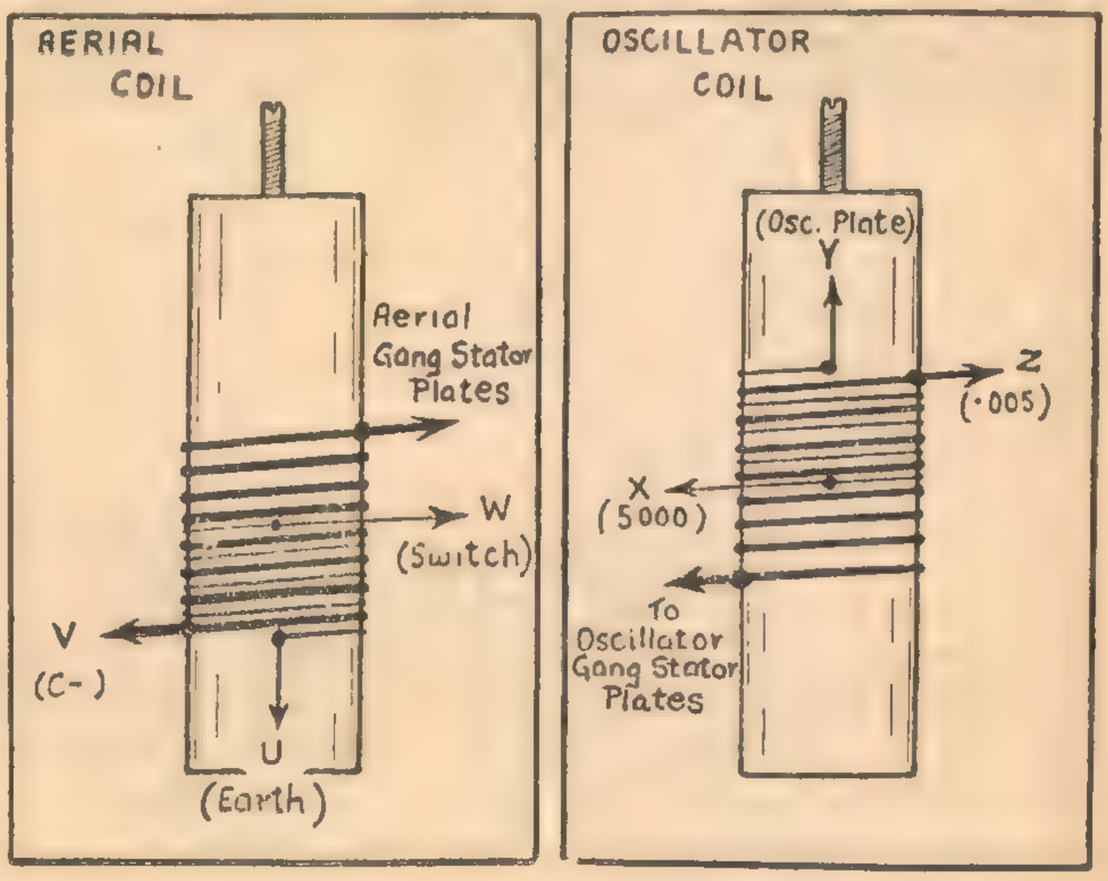

Figure 7. The Crown coils are not color-coded. However, you should be able to identify the various leads with the aid of these diagrams. The two coils differ in respect to the position of the primary winding, which is at the end nearest the core adjustment in the case of the oscillator coil, and remote from it in the case of the aerial coil. When connecting up the coils be careful not to break off the leads by too rough handling.

WIRING DIAGRAM FOR CROWN CONVERTER

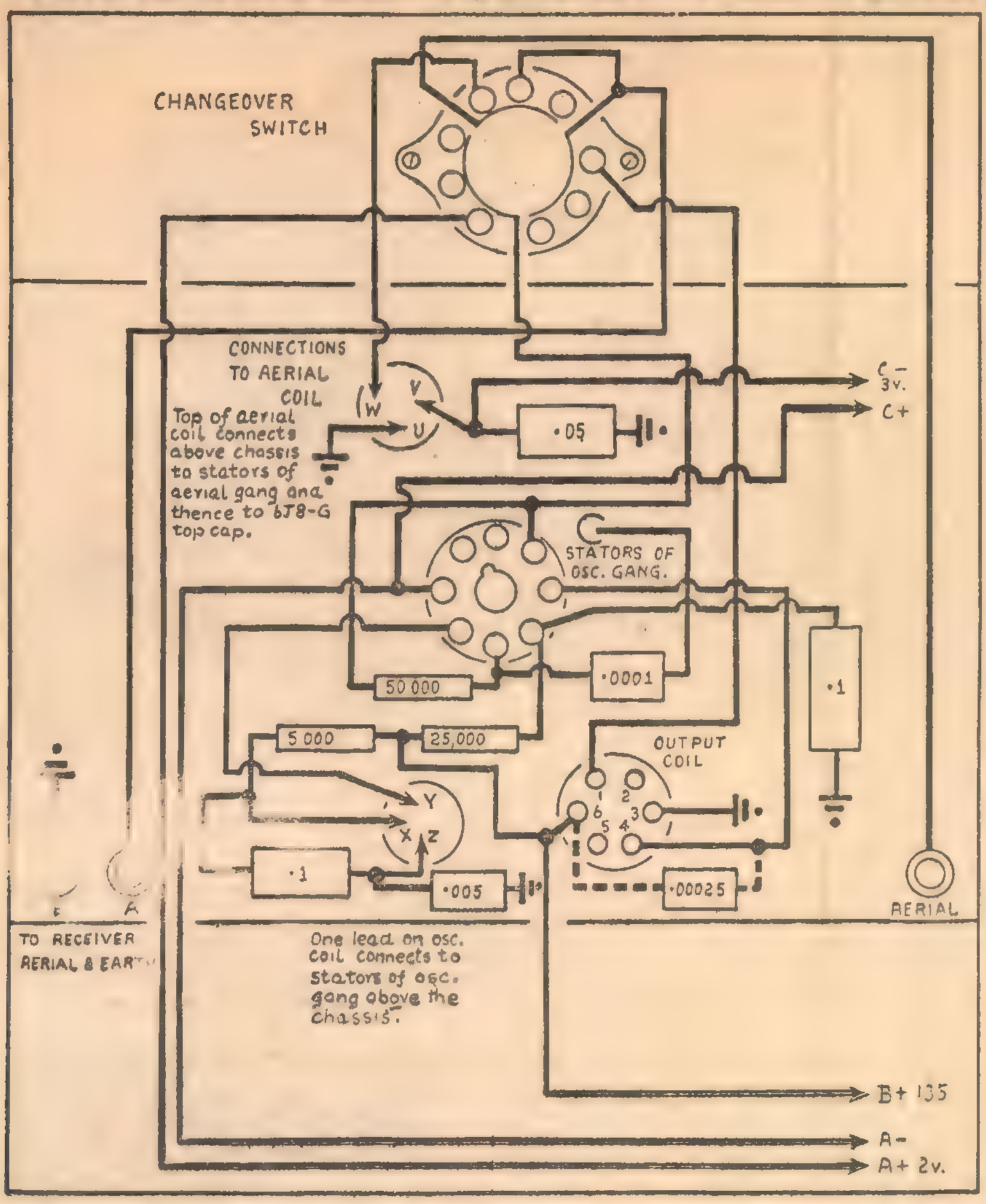

Figure 8. The underneath wiring diagram for the converter using the Crown coil kit. Both the aerial and the oscillator coils are mounted above the chassis and, in each case, the "hot" end of the coil is connected above the chassis to the respective stator plates of the tuning gang. Note the .00025 mfd condenser across the output coil, the purpose of which is explained in the text.

rent is purely a static one, although we are inclined to believe that it helps in the matter of oscillation.

The net effect of these changes was to lift the grid current to a satisfactory figure. At 20 Mc/s it was 85 microamps, or .085 mA. It rose to a maximum of 109 microamps at the centre of the band, falling again to 65 at the extreme low frequency end. During these measurements the valve was operating from a set of batteries which were none too fresh, and which were delivering a high tension voltage of only 115 volts. The current drain for the converter was just over 7 milliamps.

THE CHASSIS

As far as the construction of this simple converter was concerned, we built it up on a small aluminium chassis which happened to be on hand. Actually, it was the same small chassis used for the a-c version of the RCS converter described last month.

As we have explained on previous occasions, the chassis manufacturers have their hands very full at the moment, and we can hardly expect them to turn out all kinds of special chasses, as they did in the days of peace.

This converter is such a simple arrangement that you should not have much difficulty in finding some small chassis to accommodate it. On the other hand, with a little ingenuity and paint, you may be able to fashion a small chassis for yourself.

The photographs give a fairly good idea as to where everything fitted in in the original, although there is no need to follow the layout exactly. The main thing is to keep the leads to the oscillator coil and value socket as short as possible. Do not forget to connect up the tuning condenser; the fixed plates go to the coil, the rotors to the chassis.

As far as the leads are concerned, they are not numerous, and you should have no difficulty in following the circuit and the underneath wiring diagram.

For the battery leads, we did things the lazy man's way, simply twisting them together and bringing them out through holes in the chassis. Where the converter is to become a permanent item of equipment, it is just as well to take them all to an outlet socket and to make up a battery plug to suit. This is decidedly the neater method.

A five-pin plug and socket would be suitable for the purpose, although a four-pin could be used by poining A-minus and C-plus at the socket. Be careful to mark all the leads clearly, to avoid the possibility of getting things mixed up.

Errata Note

IT is regretted that in our last issue there was a slight error in the wiring diagram of the No. 3 converter circuit (Fig. 14). In the note toward the bottom of the diagram beginning "Connection Y on the oscillator coil. . ." the letter Y should be omitted, the note reading, "One connection on the oscillator coil . .," etc. We suggest you make the necessary amendment at once to avoid possible trouble at a later date.

TWO CONTROLS

The converter has only two controls—namely, the tuning control and the change-over switch. This switch is of the 3 x 3 single-bank wave-change type. In one position, it closes the filament circuit of the converter valve, connects the aerial to the converter input, and connects the output of the converter to the aerial terminal of the receiver.

In the second position, the filament circuit is broken, the converter disconnected from the receiver, and the aerial

PARTS LIST FOR THE CROWN CONVERTER

- 1 chassis, 8½ x 5½ x 2¼ (Little General).
- 1 Crown coil kit: 1 aerial, 1 oscillator, 1 output coil.
- 1 two-gang tuning condenser.
- 1 tuning dial, scale 0-100.
- 2 .1 mfd tubular condensers.
- 1 .05 mfd tubular condenser.
- 1 .005 mfd mica condenser.
- 1 .0001 mfd mica condenser.
- 1 .00025 mfd mica condenser.
- 1 50,000 ohm resistor, 1 watt.
- 1 25,000 ohm resistor, 1 watt.
- 1 5000 ohm resistor, 1 watt.
- 1 5-pin power outlet socket and plug (if required).
- 2 trimmers (if required).
- 1 3 x 3 single-bank wave-change switch.
- 1 wafer octal socket.

VALVE: 1 type 1C7G or 1C6.

BATTERIES: 1 2v A battery, 3 45v B batteries, 1 4.5v C battery (converter will normally be supplied by the A and B batteries of the main receiver).

SUNDRIES: 2 knobs, 3 terminals, 1 dial drive, 1 grid clip, hook-up wire and shielded wire, nuts and bolts, solder lugs, etc.

connected straight through to the receiver aerial terminal. The third position of the switch is blank.

It is not a difficult matter to connect the converter up, once it is completed. First disconnect the aerial from the main receiver and connect it to the aerial terminal of the converter. Next connect the output terminals of the converter to the aerial and earth terminals of the receiver. For this purpose a short length of shielded lead is best used.

Use the inside wire as the "live" connection and the outside metal shielding as the connection between the chassis of the converter and the earth terminal of the receiver. The normal earth wire will also be connected to the earth terminal of the receiver.

SWITCHING ON

The final job is to connect the battery leads of the converter to the batteries. Connect the converter first of all to its own C battery, and to the A and B batteries of the main receiver.

With the converter switch in the "converter off" position, the converter valve should show no glow in the filament and the broadcast receiver should operate in the normal manner. Make sure that you do not accidentally set the switch in the blank position, or the aerial will be disconnected altogether.

Having made sure that the receiver operates normally with the switch in the "off" position, turn it to the "converter on" position. The converter valve filament should now glow a dull red and the broadcast stations should disappear altogether or, at least, be very much weaker.

NOTE DIAL SETTING

Now turn the receiver dial to a point where there is no strong broadcast signal coming through. It is usual to choose a point towards the low-frequency end of the band, although this is by no means essential.

Having chosen a suitable spot, take careful note of the dial setting. The idea is always to set the receiver dial to this position when the converter is in use. This precaution ensures that the short-wave stations will always be heard at the same position on the converter dial.

Careful tuning of the converter dial should now bring to light a few phone

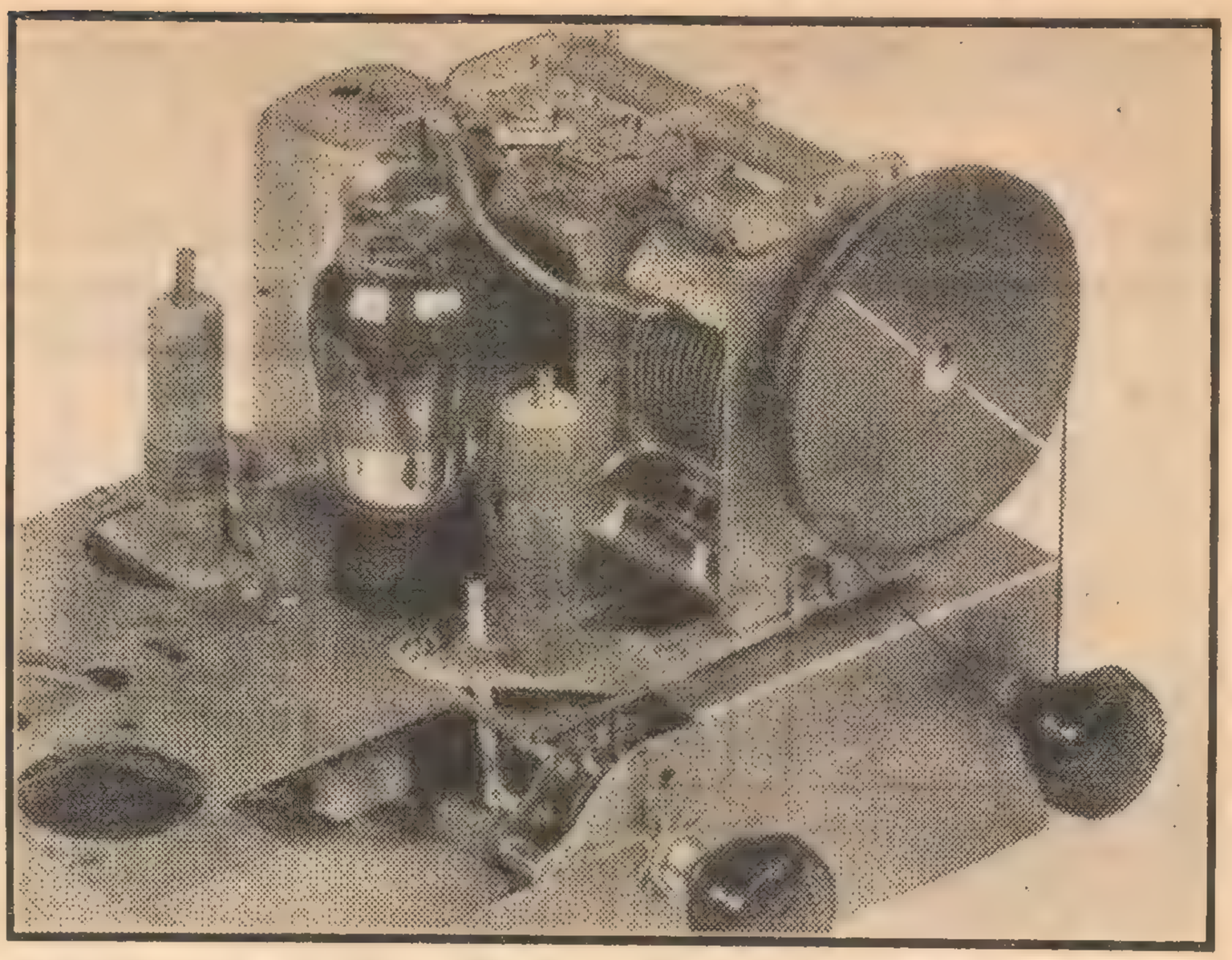

Figure 9. Just as we did in the case of the a-c version, we built up the Crown converter on the "Little General" chassis, with the idea of housing it in the "Little General" cabinet. This close-up photograph gives an excellent idea as to how the parts are arranged. The aerial coil and tuning gang are to the front of the chassis, the oscillator to the rear. The output coil is behind the tuning condenser.

or Morse signals. Do not be dismayed if you do not hear a whole lot of stations at first try. It takes a while to discover the bands on which overseas stations transmit and the times of day to listen.

We suggest that you would do well, in this connection, to read through the short-wave notes for the last two or three months and see what Mr. Whiting has to say.

CROWN CONVERTER

The second converter circuit is that using the "Crown" coil kit. As mentioned earlier, the "Crown" kit is rather more elaborate than the RCS, and requires a little more skill in the wiring-up and adjustment.

Lack of space does not permit us to discuss every detail of the construction. However, the various points were discussed at some length last month in connection with the a-c version. Those intending to build up this converter should read through the earlier article.

The Crown kit provides for a sharply tuned aerial circuit, and therefore re-

(Continued on Page 54)

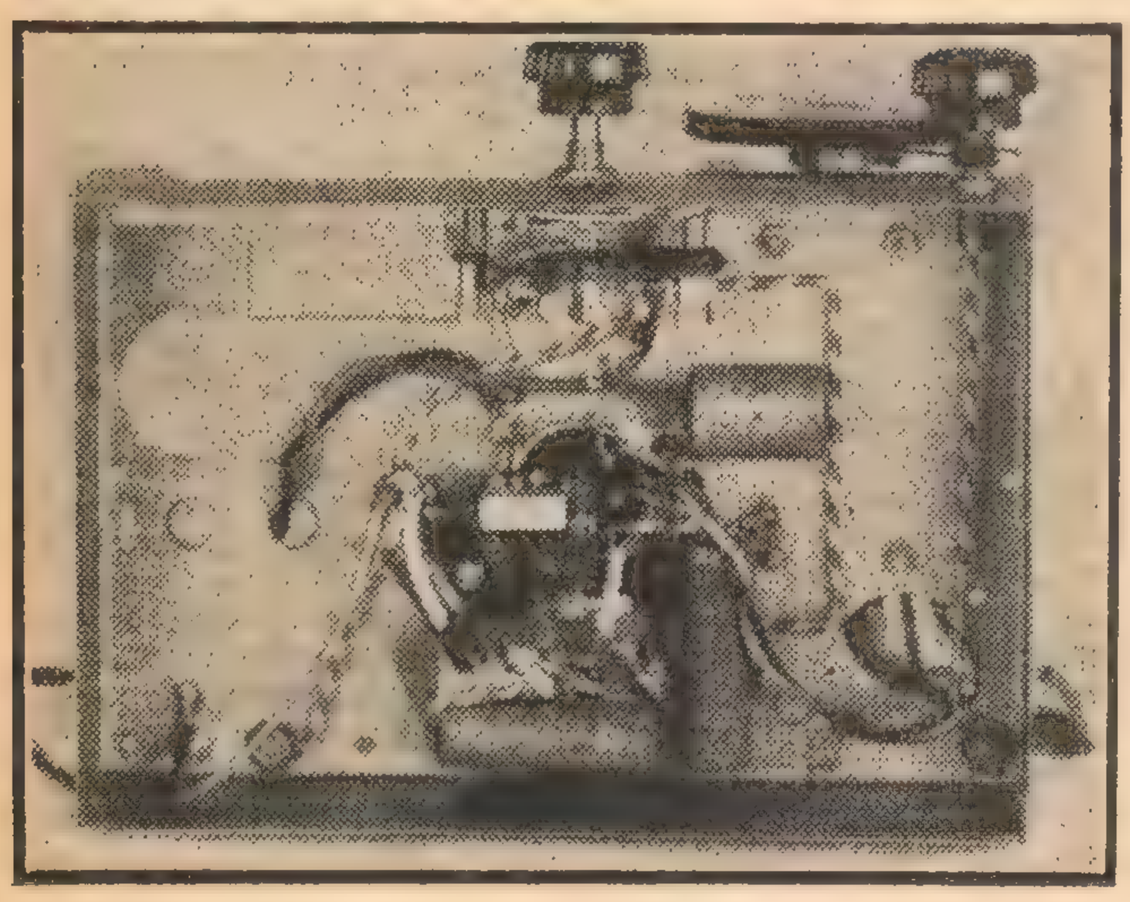

Figure 10. The underneath view of the short-wave converter built up on the "Little General" chassis. As we explained elsewhere in the article, the converters were first wired up with A-minus, B-minus and C-plus going straight to earth, but this was changed to avoid the danger of short-circuiting anything when the converter was coupled to the receiver. If you follow the circuit and wiring diagram you will not go wrong in this connection.

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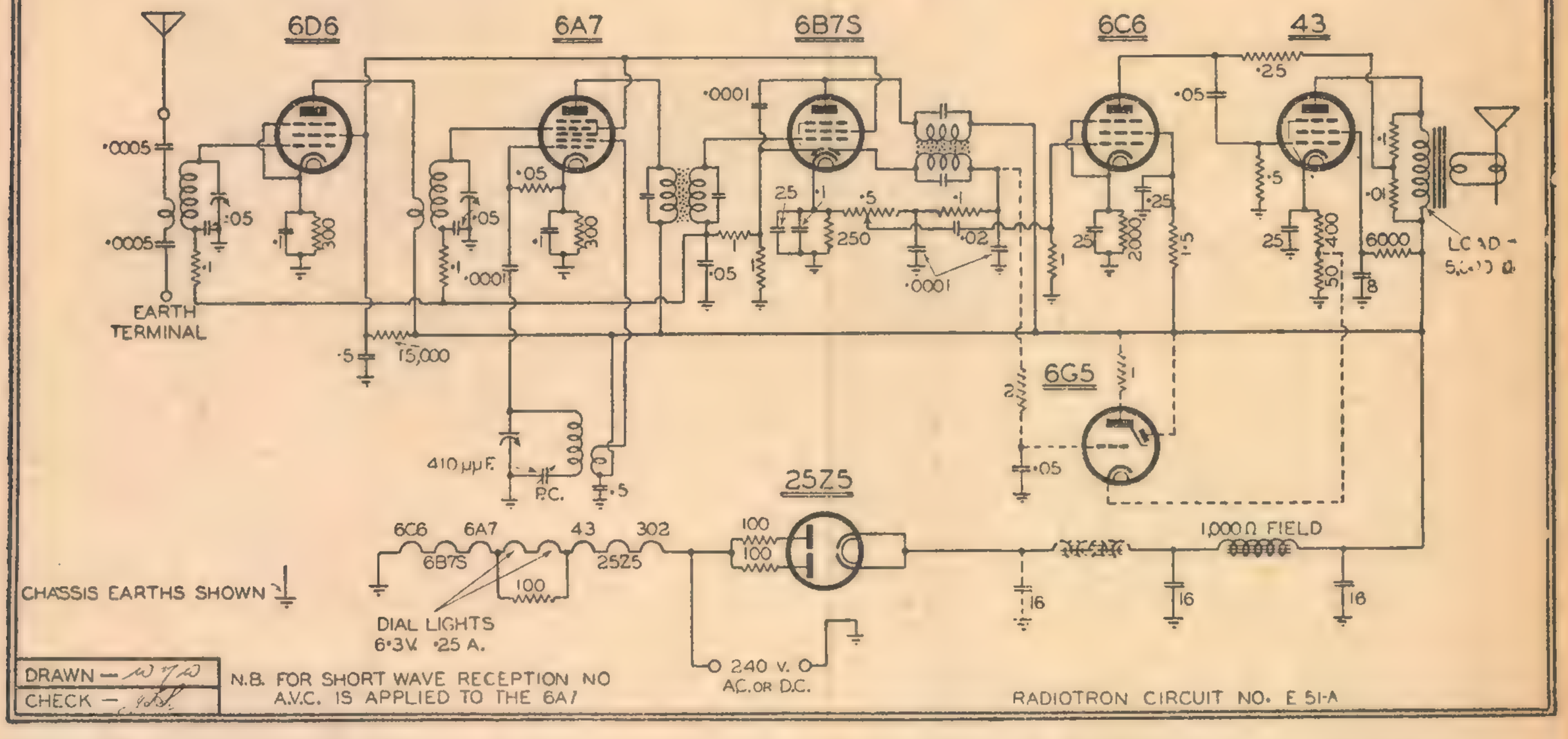
A FEW NOTES ON AC-DC RECEIVERS



From "Radiotronics" number 79 comes this typical ac-dc receiver circuit. It is along perfectly conventional lines and should not present any great difficulty to the experienced set constructor Equivalents for the various valve types are suggested in the text.

Readers will remember that last month we published an article on "The Design Of DC Mains Receivers." It was our intention at the time to add a few paragraphs in regard to ac/dc receivers, but lack of space made it impossible. However, according to the old saying, it is "better late than never."

AS the name implies, ac/dc receivers are so designed that they will operate either from ac or dc mains. In many respects the design problems for receivers of this type are similar to those for ordinary a-c receivers, and much of the article dealing with the latter applies equally well to ac/dc receivers.

As was previously explained at some length, the fact that a receiver is required to operate from d-c mains precludes the possibility of using a mains transformer. As a result, it becomes impossible to isolate the mains from the electrical circuit of the receiver.

Since the mains are invariably connected to earth in one way or another, it follows that the electrical circuits of the receiver, and usually the chassis itself, may assume a definite potential with respect to earth. As a result, the connection of an earth wire to the chassis may cause a direct short-circuit of the power mains.

A further danger is that some person may make accidental contact with the chassis of the receiver and with an earth, with serious results. Again, unless due precautions are taken, the mains voltage may be applied to the aerial itself, so that it becomes "alive."

It was pointed out that, to minimise such dangers, one of two measures was necessary. The first was to completely enclose the receiver chassis in a cabinet fitted with a door and an automatic switching arrangement, so that contact could not be made with the chassis with the power connected. The aerial and earth connections were to be made to external terminals, coupled to the terminals on the chassis by suitable blocking condensers.

ISOLATING CHASSIS

The second method suggested was to isolate the negative side of the mains and the electrical circuit of the receiver from the chassis, returning all negative connections to an insulated busbar. The latter was to be bypassed to the chassis by a large paper condenser.

For a d-c mains receiver, either of these methods is quite satisfactory, but for an ac-dc receiver the latter method is not altogether the best.

It will be appreciated that, with the chassis of the receiver earthed and the power plug inserted in one particular way, the full mains voltage appears between the chassis of the receiver and the insulated busbar within the chassis. The mains voltage is therefore directly across the isolating condenser.

With d-c mains this is not particularly important, provided the condenser has a high enough voltage rating. Once the condenser has charged, no further current flows through the earth lead.

OBJECTIONS ON A.C

In the case of a-c mains, the strain on the condenser is very much greater, which is an objection in itself. Again, there would be a considerable flow of current through the earth lead at all times and accidental contact with the chassis and the earth lead could cause an unpleasant shock, even if it were not sufficient to do physical damage.

A still further objection is that an a-c potential between the negative busbar and the chassis, which acts as the shielding medium for the various circuits, is liable to cause severe modulation hum effects.

Of course, if such effects are apparent, they can be obviated by reversing the power plug in the socket. However, this is not easily done with 3-pin plugs, and in any case the listener may overlook or forget instructions along this line and lodge a complaint that the receiver "hums terribly on a station."

For the above reasons, we are inclined to favor the idea of constructing ac-dc receivers along conventional lines, housing them in cabinets fitted with a door

and isolating switch. The isolating condensers in series with the aerial and earth leads can then be made quite small and the danger of shock to the user thus minimised.

Reference to the "Radiotron" circuit, reprinted on this page, will show isolating condensers of only .0005 mfd.

In regard to the valve heaters, the same problems apply as were discussed in connection with d-c receivers. It is suggested that you read again pages 40, 41 and 42 of the August issue.

VALVES AVAILABLE

At the present time, in Australia, it is more or less necessary to use valves having heaters rated to draw a current of 0.3 amp. This category includes the usual valves for the early stages of the receiver and special valves with high heater voltages for the output valve and rectifier.

In series with the heaters may be connected a heavy duty resistor or a 302 barretter tube, as outlined in the August issue.

The order in which the filaments are connected in an ac-dc receiver is important. Usual practice is to connect the detector and first audio amplifier adjacent to earth. If this is not done there is a distinct possibility of introducing a considerable amount of hum.

The dial lights should not be at too high a potential with respect to the chassis, not only from the point of view of safety, but to minimise the risk of the insulation breaking down. The dial lights need to be fairly heavily shunted, for reasons outlined in the earlier article.

THE RECTIFIER

It is usual to apply the mains voltage direct to the heater circuit, taking the high tension supply through a half-wave rectifier and filter system. On d-c the rectifier simply passes the current through, introducing a small voltage drop because of its internal impedance.

If, on d-c mains, the power plug is inserted the wrong way round, the rectifier passes no current whatever and no potential is present on the high tension line of the receiver. This "one way" action of the rectifier on d-c allows one to use electrolytic filter condensers in an ac-dc receiver; a reverse voltage cannot be applied to them while ever the rectifier is in circuit.

A little thought will show that the rectifier must be connected as a half-wave rectifier, so that the ripple frequency on a-c mains is only 50 c/s instead of the usual 100 c/s in ordinary a-c receivers.

FILTER PROBLEMS

Because of this low ripple frequency, it is essential to use more filtering than in the normal a-c receiver. If a single section filter is used, the filter condenters should be at least 16 mfd. each. Actually a two-section filter is desirable, with filter condensers as large as possible.

The problem of hum may be simplified by keeping the gain of the audio amplifier fairly low, although this is only really possible when there is ample gain ahead of the detector.

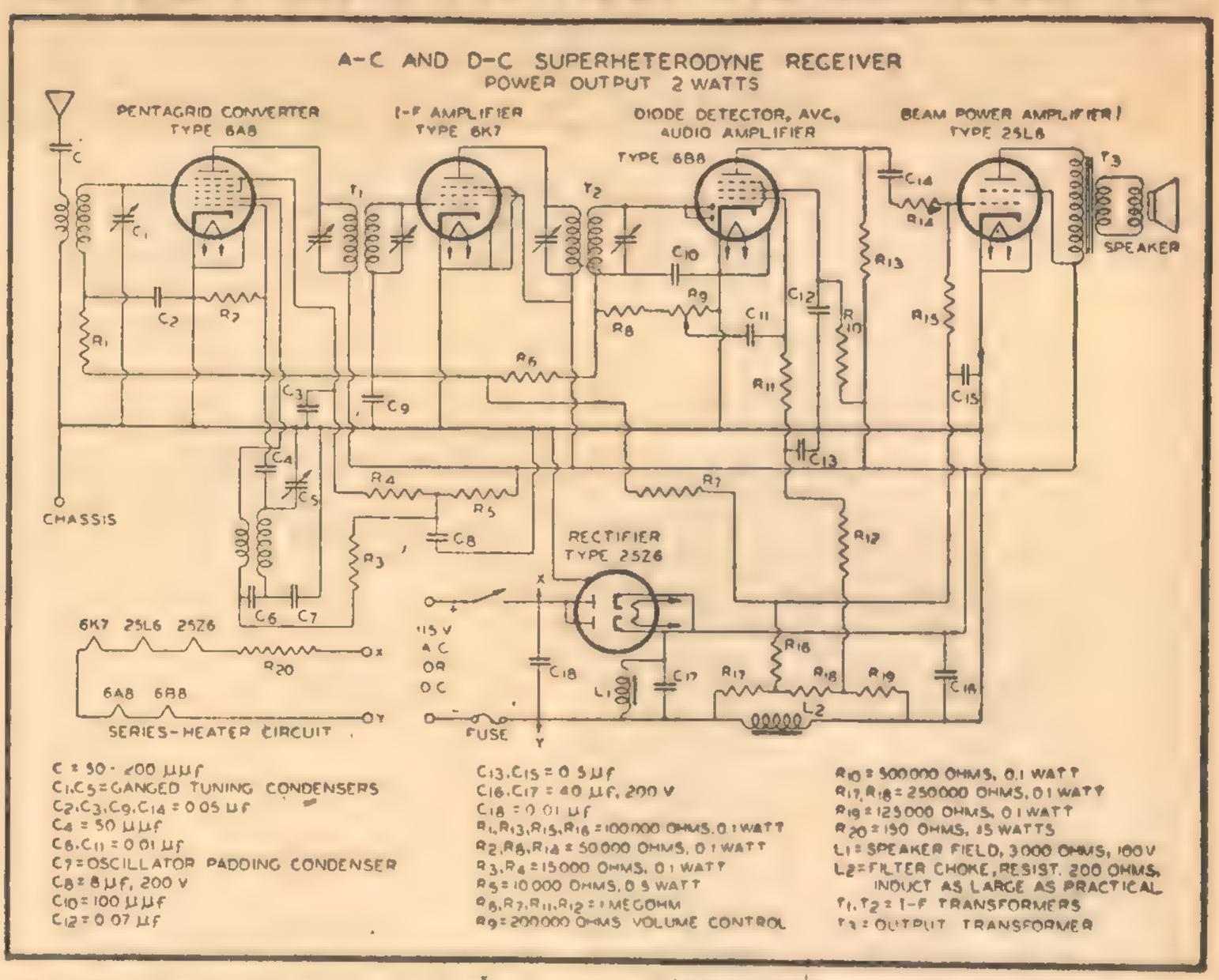
With d-c mains, it follows that the maximum high tension voltage available is the mains voltage less the drop across the rectifier and the filter system. The actual voltage obtained will naturally vary according to the circuit arrangement and the requirements of the particular output valve used.

For the sake of convenience and to maintain consistency of operation, it is desirable to arrange matters so that the high tension voltage remains about the same when the receiver is connected to a-c mains.

This necessitates a certain amount of juggling with the rectifier curves and the operating conditions. If the load current is too light, it will be found that the high tension voltage will rise when the receiver is connected to a-c mains. If the load current is too heavy the reverse may be true.

This subject is rather a large one and we would rather leave it to another occasion, when we can arrange a complete article on power supply design and the use of rectifier curves.

CIRCUIT FOR 110-VOLT AC-DC RECEIVER


A-C AND D-C SUPERHETERODYNE RECEIVER
POWER OUTPUT 2 WATTS
PENTAGRID CONVERTER TYPE 6A8
I-F AMPLIFIER TYPE 6K7
DIODE DETECTOR, AVC, AUDIO AMPLIFIER TYPE 6B8
BEAM POWER AMPLIFIER TYPE 25L6
SPEAKER
CHASSIS
RECTIFIER TYPE 25Z6
115 V A C OR D C
FUSE
6K7 25L6 25Z6
6A8 6B8
SERIES-HEATER CIRCUIT
C = 50 - 200 µµf
C1,C5 = GANGED TUNING CONDENSERS
C2,C3,C9,C14 = 0.05 µf
C4 = 50 µµf
C6,C11 = 0.01 µf
C7 = OSCILLATOR PADDING CONDENSER
C8 = 8 µf, 200 v
C10 = 100 µµf
C12 = 0.07 µf
C13,C15 = 0.5 µf
C16,C17 = 40 µf, 200 v
C18 = 0.01 µf
R1,R13,R15,R16 = 100000 OHMS, 0.1 WATT
R2,R8,R14 = 50000 OHMS, 0.1 WATT
R3,R4 = 15000 OHMS, 0.1 WATT
R5 = 10000 OHMS, 0.5 WATT
R6,R7,R11,R12 = 1 MEGOHM
R9 = 200000 OHMS VOLUME CONTROL
R10 = 500000 OHMS, 0.1 WATT
R17,R18 = 250000 OHMS, 0.1 WATT
R19 = 125000 OHMS, 0.1 WATT
R20 = 150 OHMS, 15 WATTS
L1 = SPEAKER FIELD, 3000 OHMS, 100 V
L2 = FILTER CHOKE, RESIST. 200 OHMS, INDUCT AS LARGE AS PRACTICAL
T1,T2 = I-F TRANSFORMERS
T3 = OUTPUT TRANSFORMER

For those readers who may be interested we reprint this 110-volt AC-DC receiver circuit from the RCA Valve Manual RC 13. Equivalents for the various valves are suggested at the end of the article.

In USA, where the line voltage is usually around the 110-volt mark, the high tension available on d-c is rather low after subtracting the various losses. Frequently the manufacturers of small ac-dc receivers connect the rectifiers as voltage-doublers, so that, on a-c at least, the receiver will have a fairly high B-plus supply.

In Australia, where the mains voltage is more usually between 220 and 240 volts, the same need does not arise.

LINE FILTER?

Since the receiver may be used on d-c mains it is well to consider the possibility of having to instal some form of line filter, in addition to the regular high tension filter. Reference should be made to the discussion on the subject on pages 39 and 40 of the last issue.

For those who may require them, two circuits are reproduced herewith. The first is a "Radiotron" circuit, originally published and described in "Radiotronics," number 79, and since slightly amended.

It is designed for Australian conditions, and is along perfectly conventional lines. All negative returns are shown as being returned direct to the chassis. For reasons already outlined, the chassis should therefore be enclosed to prevent accidental contact with chassis and earth.

Connections to the aerial and earth are through isolating condensers of .0005 mfd. These terminals should preferably be mounted on the back of the cabinet and easily accessible.

The valves specified are, in all cases, the old style 6 and 7 pin types. The only reason for this was that these types were current at the time the cir-

(Continued on Page 56.)

THOSE SPARE PARTS!

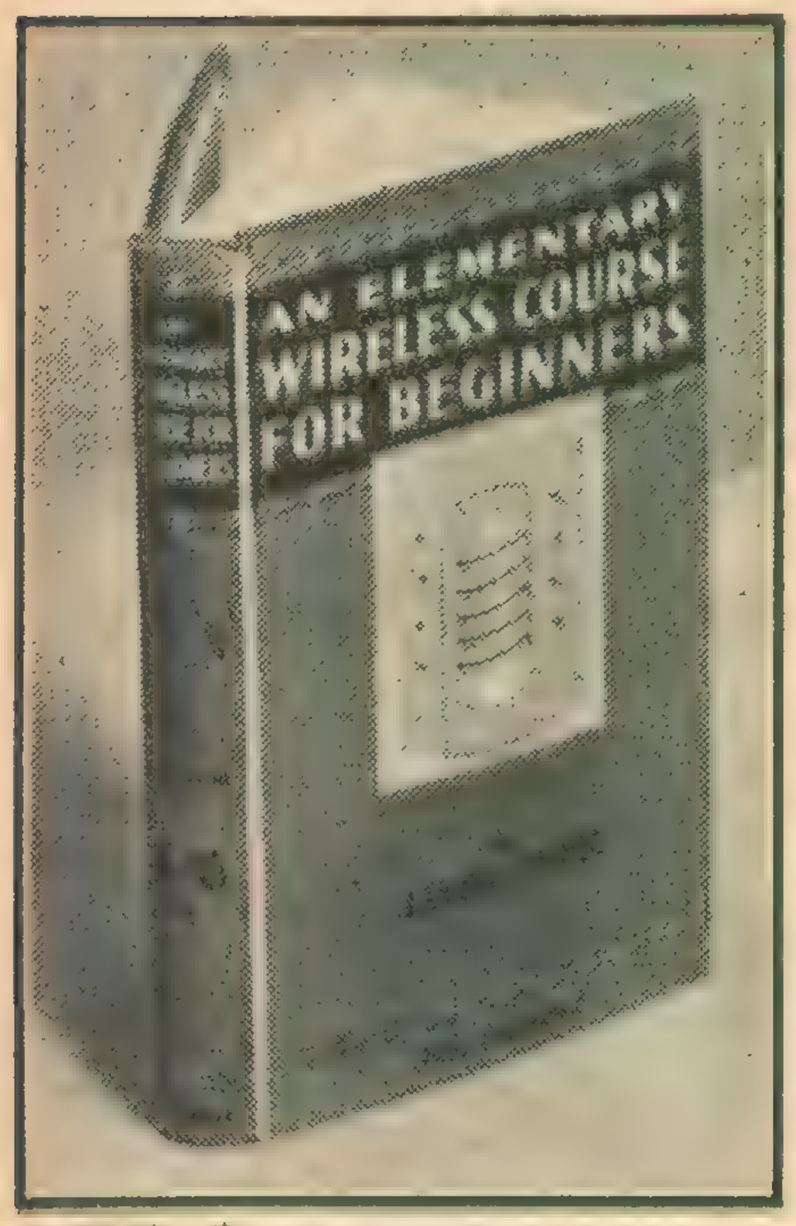
In these days when new parts are so scarce, don't have a lot of used parts lying around doing nothing. Help yourself and help others by offering them for sale.

"Radio and Hobbies" makes it possible for you to do this at small cost in the "Wanted To Buy, Sell or Exchange" column. The rate is 9d per line for a minimum of three lines — making the minimum charge 2s 3d. This column and the special rates are available for the exclusive use of home-builders and enthusiasts.

TRADE NOTES AND NEW RELEASES

"AN ELEMENTARY WIRELESS COURSE FOR BEGINNERS"

By J. H. Reyner



THIS particular book was mentioned briefly in the July issue, in the article on Radio Textbooks. Comprising 279 pages in all, it is by the well-known English technical writer, J. H. Reyner.

The majority of radio textbooks start off with a discussion of the electron theory, passing on to current, voltage, resistance, inductance, capacitance, &c., finally showing the application of this basic theory in radio components and circuits.

Reyner's book begins the other way about. He imagines that the reader and writer are looking into the workings of a typical radio receiver, and that the reader is asking questions as to the operation and function of the various components to be seen.

Typical questions are: What is a coil for? Why is there more than one coil? What are the metal cans for?

The book is well illustrated, and the novel manner of presentation makes it very easy to read, for a technical manual. Its widest appeal would be to those who are more or less familiar with the internal appearance of a radio receiver and who are anxious to learn something of the operation.

Our copy from Levenson's Radio, 226 Pitt-street, Sydney. Price 6s 9d.

"SHORT-WAVE WIRELESS COMMUNICATION"

By Ladner & Stoner

FROM the publishers, Messrs. Chapman and Hall, of London, we have received a specimen copy of the fourth edition of the work by Ladner and Stoner, "Short-Wave Wireless Communication, Including Ultra-Short Waves."

Earlier editions of this work have found favor, both as a textbook for students and as a reference manual by radio engineers. Although based on the earlier editions, this, the fourth edition, has been considerably revised and expanded.

Briefly, the book outlines the history and development of short-wave transmission. Then comes a discussion of modulation, and problems of short and long distance transmission on short and ultra-short waves. Feeders, aerials, and aerial arrays are treated in separate chapters, as are oscillators, power amplifiers, and modulators.

Then follow chapters on reception problems and receivers generally, and on commercial wireless telephone circuits. A final chapter deals with the subject of "High Frequency Therapeutic Apparatus."

Stocks of this fourth edition are expected to arrive in Australia shortly. It is anticipated that the price will be in the vicinity of three guineas.

SHORTAGE OF COMPONENTS

Minister To Investigate

ASKING the Minister for Munitions to consider the difficulty being experienced in obtaining maintenance parts for wireless receivers, the Postmaster-General (Senator Ashley) said that it would be a matter of grave concern if listeners were deprived of the use of their sets through inability to obtain essential parts.

Senator Ashley said that the radio industry was confronted with difficulties in obtaining adequate supplies of valves, batteries, condensers, and other essential replacement parts.

VALUE OF RADIO

He commented that broadcasting afforded an excellent medium for the dissemination of Government announcements, and its value in this direction would be very much greater in the event of actual hostilities occurring in Australia, or any other grave emergency.

"The important part which radio would play in the maintenance of public morale is realised by the Government," he said.

"I regard it as imperative, in the interests of public safety, that there should be a wireless receiver in every home, but from the information placed before me it would appear that unless the present position regarding supplies of essential spare parts is improved, a large proportion of the population will, in the course of time, be unable to use their sets."

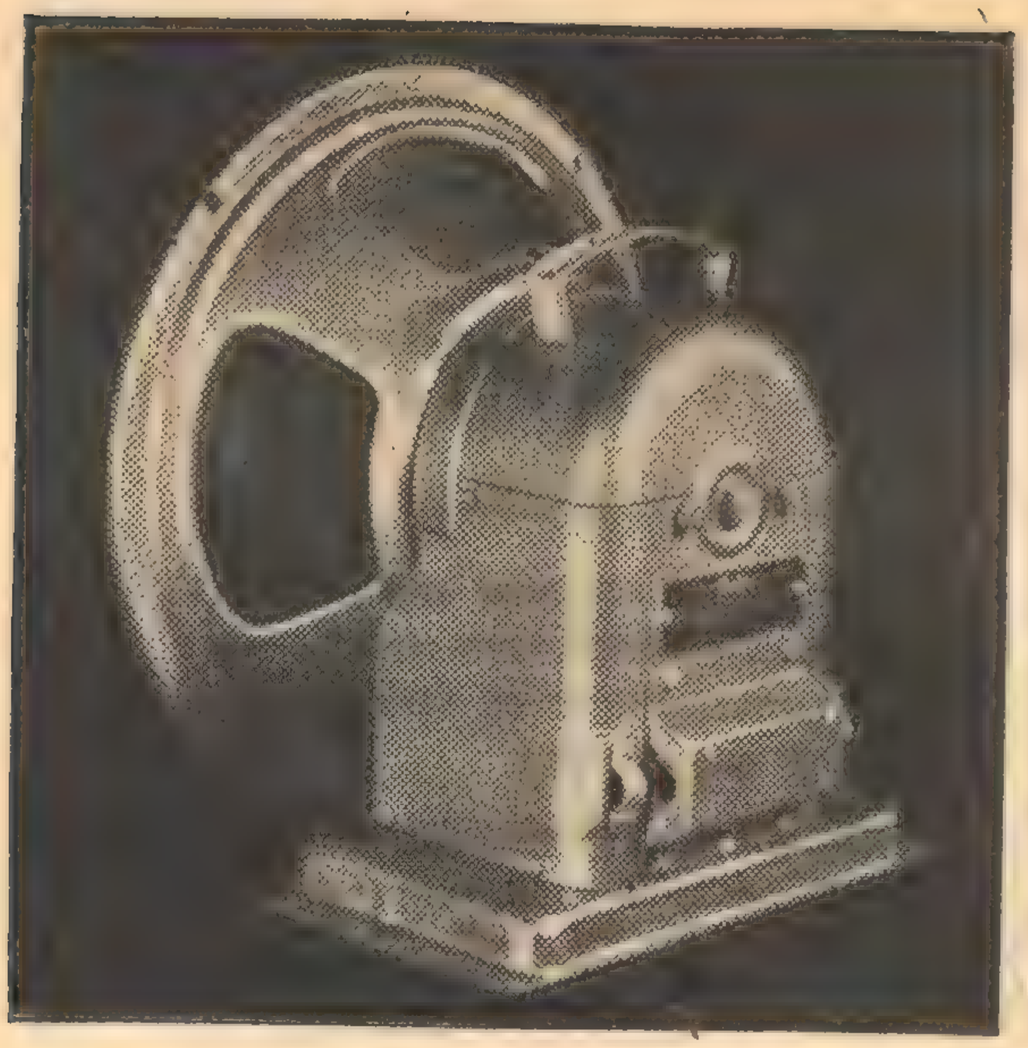
He said that the outlook in respect of battery operated receivers, which were extensively used in country districts, appeared to be particularly serious, because batteries in normal circumstances required replacement at fairly frequent intervals.

FEWER LICENCES

The number of broadcast listeners' licences had in recent months shown a decided downward trend, and this was probably due to the difficulty in obtaining renewals of essential parts for the sets.

Senator Ashley expressed to the Minister for Munitions the view that if it was practicable to ease the position without interfering with the output of essential defence equipment, supplies of the necessary materials should be released for civil purposes as soon as possible.

With officers of the Munitions Department, Mr. Makin is investigating the position.



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THE MONTH ON SHORT WAVES

by Ted Whiting

CONDITIONS CHANGING

Watch High Frequency Bands

At this time of the year, with the change of seasons impending, we experience a very definite change in conditions and in the hours of best reception. It is this change which brings the 16-meter band under our notice.

AT this location, it is our practice to keep a very close watch on the bands which are, to all intents and purposes, dead as far as reception is concerned. We have in the past heard some very interesting transmissions from various parts of the world, when conditions were not supposed to be conducive to reception over long distances.

On tuning carefully over the 16-metre band at the present time it will be noticed that several stations are audible at around 10 pm, and it will be found in addition that, as time goes on, the strength of these stations will increase, until we are experiencing the reception we are accustomed to in the summer season.

We are, at this location, receiving signals on this band from Germany, London and Rome. In addition to this, we are hearing quite good signals from America in the early morning and, during the day, we can hear the news at midday from Japan, and from the Japanese controlled station in the Dutch East Indies.

It is also customary to hear at good strength the transmitter on this band operating in the Pacific service at from 5 pm.

13 METRE BAND

Signals on this band were not very satisfactory during the last summer season, but we are expecting that the signals will be much better this year and in subsequent years the strength will increase until we get reliable signals of entertainment value. The quality of signal on this band is good when conditions are right, as are the emissions heard on the 16-metre band.

FROM SWITZERLAND

We are pleased to draw our readers' attention to the news service that is being operated from Berne in Switzerland. The inaugural transmission is taking place on August 1 on a wave-length of 25.28m, and is heard from 0745 to 0915 Swiss summer time. This corresponds to 4.45 pm to 6.15 pm Eastern standard time.

Transmissions are being made in the English language on Tuesdays, and in national languages on Saturdays at the same times. These transmissions can be heard at very fine strength at these times, and in the weeks to come will be heard even better. We would ask for reports on these transmissions, as the Swiss authorities have asked us to supply them with reports with a view to the improvement of the service.

The quality of the transmission, as heard during the test transmissions, left nothing to be desired and we have, in fact, written to the station asking them to supply details of the recordings used and as to the method of transmission.

Reports may, of course, be sent out in the usual way, but we are not in a position to say whether mails are being transmitted to this country. Any reader who wishes to do so, may send their reports to us, and we will endeavor to pass them on to the Swiss authorities in the hope that they will reach the station concerned.

We are also advised that the regular monthly transmission, which has been in service so long, will be discontinued as from August 2. This is, of course, the programme we have been hearing from Prangins on 26.31m and on 20.64m.

The new station uses a lady announcer with a very good and incidentally very fascinating voice. Most of the announcements are in the following formula. "The next item on the programme from Berne—."

Last Minute News

FROM August 1 Station WGEO is to operate on a wave-length of 31.08m, instead of the wave-length given here. Regular announcements are made from the station. The signal has improved very much by the change.

WE have just heard from Dr. Gaden, who has heard a station operating on 59.4m. This station, WDI, is now to be heard at from 5.45 pm on 9700kc. We have no knowledge as to whether this will affect the relay stations in any way, but we will maintain a watch, and hope to include full details in next month's issue.

THOSE MYSTERY STATIONS!

WE have had many letters asking us to detail regularly the stations which are puzzling our readers, and to give details of these stations, so that we can share in their identification. Here are a few for this month. A station is being heard on 18.73m at 2.30 pm. This one does not seem to us to be on a regular schedule.

There is a station being heard at about 11 pm in the 49m band. This one is on approximately 48.3m; and is heard at fair strength. Chimes are heard at 11 pm, and also at midnight. The announcements are in Spanish.

Many stations for which we cannot find any information are now to be heard in the bands above 50 metres. We would welcome any reports on these stations as we find that they are received in better manner in country districts than they are in this location.

STATION ADDRESSES

WE have in the past few weeks been deluged with requests for the address of many stations which are being heard at the present time, and in order to help our listeners as much as we can we are listing a few this month. Next month we will endeavor to list more.

MTCY.—Central Broadcasting Station, 601 Daido Taigai, Hsinking, Manchukuo.

TGWA.—Ministre de Fomento, Guatemala City, Guatemala.

HP5A.—Radio Teatro, Apartado 954, Panama City, Panama.

OAX4J.—Box 1166, Radio Universal, Lima, Peru.

ZRH.—SABC, PO Box 459, Johannesburg, South Africa.

COCX.—Apartado 32, Havana, Cuba.

READERS' REPORTS

THE following readers have sent in reports and letters, for which we are very grateful:—

M. Morris, Newcastle, NSW; E. H. Suffolk, Summertown, SA; J. Ferguson, Lindfield, NSW; R. Francis, Erskineville, NSW; A. Black, Rockdale, NSW; W. Harvey, Dubbo, NSW; J. W. Swingle, Brisbane, Q; Dr. K. B. Gaden, Quilpie, Q; L. Elsom, West Perth, WA; R. Simpson, Home Forces; A. Condon, Laura, SA; A. Cushen, Invercargill, NZ; A. O. Marsh, Belmore, NSW; R. Hallett, Enmore, NSW; G. Rhodes, Canberra, ACT; A. Lee, Newcastle, NSW; R. M. Churchers, Devonport, Tas.; E. J. Perret, Marrickville, NSW; N. A. Hanson, Merrylands, NSW; S. Jones, Punchbowl, NSW; R. Gillett, Dudley Park, SA.

WHEN AND WHERE TO LISTEN

Here is a chart for quick reference, giving the call and listening times for the best short-wave stations on the air. Where the station is not receivable at good strength when it comes on the air, the time is given at which reception should be satisfactory.

6 am TILL NOON

GRW, 48.86m, London. A good signal at 6am.

Bucharest, 32.41m, Roumania. Heard well at from 6.50 am.

CSW7, 30.08m, Lisbon. Opens at 6.50 am. Strength is good.

Moscow, 19.69m, Russia. Reliable from 7 am.

WGEA, 19.57m. News at 8 am at good volume.

HCJB, 24.08m, Quito. This one is audible at 9 am.

SBP, 25.63m, Motala. News in English at 11 am.

GRV, 24.92m, London. A very good signal at 11.15 am.

GRF, 24.80m, London. Best signal on the air at from 11 am onwards.

Best reception period from 8 am till noon.

Paris, 31.51m, France. Good at noon.

NOON TILL 6 pm

KWID, 19.62m, San Francisco. A good signal from 12.30 pm.

WRCA, 31.02m, New York. The news is read at 1 pm.

GRG, 25.68m, London. A good signal till 1.30 pm.

OIX3, 25.46m, Helsinski. Good listening at from 2.30 pm.

DZD, 28.45m, Berlin. A fine signal at 2.30 pm.

COCQ, 33.90m, Havana. Audible from 3 pm.

GRW, 48.86m, London. Fine signal in the Pacific service.

KET, 31.65m, Bolinas. Carries the KWID programme from 5 pm.

Best reception period 1 pm till 4.30 pm.

Reports for the next issue should reach Mr. Whiting not later than Sat., Sept. 5th, 1942.

6 pm TILL MIDNIGHT

12RO4, 25.40m, Rome. News in English at 6.15 pm.

KRCA, 28.85m, San Francisco. Heard from 6.30 pm.

WJQ, 29.97m, New York. A fine signal from 8pm.

WGEO, 31.48m, Schnectady. One of the best from 8 pm.

Saigon, 25.47m, Indo-China. Still to be heard at 9 pm.

TIPG, 31.19m, San Jose. This one is heard at 10 pm.

FFZ, 24.86m, Shanghai. News from this one at 10 pm.

HSP5, 25.61m, Panama. Hear the news at 10.30 pm.

CBFY, 25.63m, Montreal. Can be heard well at from 11 pm.

GSN, 25.38m, London. Calls from Europe at 11.30 pm.

Best reception from 9.30 pm till midnight.

NEW STATIONS OF THE MONTH

AMERICA — IRAN — CHINA — THAILAND — VATICAN CITY

WDJ, NEW YORK

IT is very appropriate that this month, we should commence this section of our notes by announcing the appearance of yet another new American station. We are so accustomed to hearing new Americans that we are apt to forget what a tremendous part this nation is playing in the matter of entertainment of their nationals who are scattered over the world. The new station is WDJ, which operates on a wave-length of 39.70m, which corresponds to 7556kc. This one is to be heard from 4 pm, when it is carrying the news in English. The transmission is concluded at 5.30 pm. The signal is heard at this location at only fair strength, but some of our interstate reporters have reported them as being at quite good strength. This one is operated by Press Wireless, as is WJQ.

E--, TEHERAN

We are in receipt of information that the Iranian broadcasting authorities have put a new station on the air. This station is to be heard from 4.45 am daily, when a service in English is in progress. The signal is a very good one, and is very steady on both the occasions we have heard them. The announcer is a male, and the station announces as "This is Teheran calling on the broadcast band on ?, and on the short-wave band on 36.99m. After the conclusion of the English transmisssion, a programme in French is to be heard. This fades out at about 7 am.

WOK, NEW YORK

Although this station is not really a new one, in the true sense of the word, we hope that we will be forgiven for including it in this column. WOK has had many uses in the past, but we now hear that it is being used in the overseas service. Mr. Condon has reported them on their old wave-length of 28.42m, carrying, on irregular schedule, a talk in English at 9 am. At 9.30 am the transmission is conducted in Spanish. The signal is at times a good one, but is more usually just fair.

KWID, SAN FRANCISCO

As yet another one from the States we note that, at the conclusion of the transmission on 19.62m, this station is now using a new outlet in the 31m band. This outlet is heard from 5 pm until 11 pm on 9570kc, which corresponds to 31.35m. The signal strength is quite good, but is not yet in the same street as its competitors from that part of the world. We had a telegram from Mr. Elsom, of Perth, who informs us that the signal reaches terrific proportions at closing at his location. The first intimation came from Mr. Keast.

Please address all short-wave reports to Mr. Ted Whiting, 16 Louden-st., Five Dock, NSW.

XPRA, CHINA

A new Chinese station has taken the air under the above call, and is operating on a frequency of 9830kc, 30.51m. We do not as yet know the location of this new addition to the Chinese short-wave system, and we would be glad to hear of any reports which will throw some light on the matter. The best time to hear this one is at about 9.30 pm when recordings are played. Our reporter who first heard this one writes that on one night a rebroadcast of a native type programme, but the relay was not a success, and was interrupted owing to conditions. This relay has been heard at this location, and has been quite successful on the occasions we have heard them. The reporter who sent us the information in the first place was Mr. Suffolk, of Summertown,

THAILAND

A new anti-British station is now to be heard emanating from the country we used to know as Siam, and from where we used to hear some very fine transmissions. This new one is heard closing in English at 11.30 pm, at very good strength. The wave-length is 41.72m, 7190kc. The location is, of course, at Bangkok.

HAT4, HUNGARY

This one is not of necessity a new one, but we list it, as it originates in a country from where we rarely hear a signal. The music radiated from the Hungarian stations is usually of a high standard and is very pleasant to listen to. This one is audible at 9 am, and may be heard well until conditions become too much for the signal, at about 10 am. The announcer, a lady, frequently states that "this is Radio Budapest, Hungary." The place to look is 9119kc, 32.90m. Although it is impossible to obtain a veri. from this one at the present time, it is a very interesting one to log.

HVJ, VATICAN

A new outlet is now being heard by the early riser, occupied in tests for Great Britain. The station is heard on 5972kc, 50.23m, and is carrying the same programme as that on 49.92m. This one reaches fair strength at times, and we have no doubt that, ere long, we will be hearing the type of service to which we have become so accustomed in the past. News read at 5.15 am.

WITH OUR S.W. REPORTERS

MR. G. WILSON

ONCE again we turn to Victoria to provide us with the material for a further article in this series covering the activities of our friends in this great hobby.

We have, on many occasions in these pages, stressed the need for the exercise of patience and perseverance in our hobby, and the case of our friend, Mr. Wilson, further stresses this point. Mr. Wilson is, unfortunately, blind, and, is, therefore, unable to take part in the game in so far as set building is concerned. He has, however, taken a very keen interest in listening for, and identifying, many of the short-wave stations, which it is possible to hear these days. The log turned in each month is always a valuable contribution to our pages, and is full of material which proves valuable to us in the compilation of these notes.

THE RECEIVER

Mr. Wilson has in the past operated many and varied receivers. The interest in listening commenced with the arrival of a crystal set some twelve years ago, and interest has been maintained with the acquisition of further receivers.

The next was a three-stage battery set, which gave very fine results at times, the main fault being that it was heavy on batteries. As time went by the present receiver came into the picture, a five-valve mantel model receiver of a very popular make. This receiver has a short-wave range of from 13 to 40 metres, is very sensitive, and operates with a lack of hiss and noise generated internally.

It is of interest to learn that Mr. Wilson has used this set in locations in both Perth and at Albert Park, Melbourne. He considers that the conditions in the west are far superior to those operating in Victoria, and that seems to be the general opinion as taken from the reports we receive from various parts of the country.

STATIONS HEARD

Mr. Wilson has in some years of constant listening compiled a very fine list of stations which he has heard, but has never been tempted to try his luck at getting cards. The favorite stations at this listening post are the Americans and the Asiatics. These in themselves offer a large scope for any listener without the rest of the world's transmitters.

That seems, we think, to cover the listening post operated by Mr. Wilson, and we have no doubt that our fellow-reporters will join with us in wishing him every success in his radio activities and hope that many more of those elusive stations will find their way down his aerial in the future. We hope that we will all benefit by this description of how one of us has surmounted very great difficulties.

THIS MONTH'S VERIFICATIONS

AMERICA.—Our friend, Mr. Perkins, writes that he has received a nice card from the WCRC-BX-DA group of stations in answer to a report sent on a transmission from WCRC some months ago. The card is a buff-colored one, and carries the station details of the group. This reporter was unfortunate not to receive a "First in Australia" for this station, as he was very little behind Ray Simpson in receiving this one.

CAIRO.—Mr. Ray Simpson writes to us to say that he has received yet another "First in Australia" from Radio Cairo, in reply to a report on their transmission on 5990kc. The customary card was sent as also were sent from WCRC, CBRX, and one from Brazzaville. The latter one was overdue from 1940.

SOUTH AFRICA.—Mr. Condon has written to us telling of the new veri's he has recently received. The first is from South Africa. The station, ZRH, sent a simple card of apology for the fact that they are not sending out an elaborate card. This is rather disappointing, but it is good to know who does verify and who does not.

CUBA.—The next one to be dealt with is COCX, who are sending a pictorial card with the call letters in red. The slogan of this station is "Casa Lavin." The address is included in our list for this month.

DOMINICAN REPUBLIC.—Mr. Condon considers the card he received from HI2G as one of his best. The card is printed mainly in Spanish, but on the card is a message in English which states that they also radiate on 6320kc, 47.46m. The card bears the call letters of the associated B/c station which they relay.

FLASHES FROM EVERYWHERE

RADIO ORANJE.—In this column last month we drew our readers' attention to what we thought was a Dutch station operating on the 19m band. Some little light has been thrown on this transmission by our own investigations and those of our readers. The transmission was in the first place carried out on 15,140kc but later was undertaken on a frequency of 15,310kc. It is significant that these frequencies are those of two of the BBC stations, namely, GSF and GSP. This transmission is totally in Dutch, and we hope in the near future to clear up this latest mystery. Many references are made to Radio Oranje. The transmission opens at 8 pm, a time which is suitable to many of us.

AMERICA.—We are informed by Mr. Cushen that only the primary station of the KGEI network will reply with a verification card. This is not surprising since under the American law these stations are only licensed for point-to-point working, and secrecy is demanded. Announcements to this effect are frequently heard from these stations on closing. We would be very interested to hear whether anyone has been fortunate in receiving a verification from any of these stations in the past. This will also apply to stations operating in connection with KWID in the afternoon and evening.

SINGAPORE.—We are informed by our reporters that the station we became so accustomed to hearing in the past has recommenced operating under Japanese control. This one is operating on 25 metres. The announcer is one of those gentlemen speaking in his own language, and announcing the new name from Singapore. English is spoken at 10 pm, and the station is heard to close at 11.30 pm.

HONGKONG.—This one has now been moved from its old frequency to a new one of 31.70m. The schedule is the same, and at the present time is being heard well in the evening.

50 METRES AND OVER

THERE are many stations operating on these bands each night. They can be heard at no great strength, but we hope that those readers operating sets capable of covering these bands will suffer the noise and try to help us identify them.

4390kc.—Possibly a Javanese. Heard from 7.30 pm to 10.30 pm.

3700kc.—Also seems to be a Javanese.

3100kc.—The same remarks apply to this one.

3380kc.—This one sounds like one of the Indian radio stations, which are to be heard at this time. These stations usually close at 2 am. A listener in South Australia has brought to our notice the fact that he has heard an American station operating on an announced wave-length of 59.4m. This station is heard at fair strength at 7.30 pm closing and is announced as WGI. The frequency is announced as 5345kc, which just does not seem right. However, we hope to clear this item up. This station is used in a service to China, and is relayed by a further station on 14,420kc, 20.9m. We have not heard either of these stations at this location, but we hope to hear from anyone who can bring them in.

OVERSEAS S.W. STATIONS NOW AUDIBLE

The list of stations shown below comprises only those which have actually been heard in this country during the past few weeks, and does not include stations which are on the air but not heard as yet in this country. A large majority should be heard on any sensitive receiver, and when a station is reported for the first time readers' names who report it are shown in brackets. At the end of each group is a list of correspondents who have sent in reports.

ENGLAND

GSA—6050kc, 49.49m, Daventry. Heard well at 5.30 am in European service and at 3 pm in Pacific service.

GSB—9510kc, 31.55m. In African service from 5 am to 6.30 am and in addition from 3 pm to 6.15 pm in Pacific service.

GSC—9580kc, 31.32m. Used in the North American transmission from 8 am to 2.45 pm. Good signal throughout.

GSD—11,750kc, 25.53m. This very versatile station is heard in African, North American, Pacific and Eastern services.

GSE—11,860kc, 25.29m. Heard very irregularly at about 5 pm.

GSF—15,140kc, 19.82m. This one is also very reliable. Used in African, Pacific and Eastern services.

GSG—17,790kc, 16.86m. Used in French service at 8.45 pm daily. This one is heard well in Pacific service at 5 pm.

GSH—21.470kc, 13.97m. Inaudible at this season of the year.

GSI—15,260kc, 19.66m. Heard in Pacific transmission at 5 pm.

GSJ—21,530kc, 13.93m. Also inaudible now.

GSL—6110kc, 49.10m This one is used in Pacific service. Heard well at 3 pm.

GSN—11,820kc, 25.38m. A station which is employed in the foreign service. Heard well at 11.30 pm and 6.30 am in the European transmission.

GSO—15,180kc, 19.76m. Heard in the foreign service and is heard at 10.15 pm.

GSP—15,310kc, 19.60m. This one is a fair signal in the Pacific service.

GST—21,550kc, 13.92m. Forget this one till summer.

GSV—17,810kc, 16.84m. A fair signal in the Eastern service, 8.45 pm till 11 pm.

GSW—7230kc, 41.49m. European service. A good signal at 5 pm.

GRD—15,450kc, 19.42m. Easily heard in the Pacific transmission at 6 pm, and in addition in the African service at 2 am.

GRE—15,375kc, 19.51m. Another Eastern service station at 8.45 pm.

GRF—12,095kc, 24.80m. Heard in parallel with GRV from 8 am to 1 pm. This is in a Spanish transmission.

GRG—11,600kc, 25.68m. At 5.30 am is heard in the African service, and from 6.45 am to noon in the North American service.

GRH—9825kc, 30.53m. This one in the North American service. Best at 10 am to noon.

GRI—9415kc, 31.86m. Another one which is heard irregularly at 9.30 pm.

GRJ—7320kc, 41.00m. Heard in the European service at 6 am and 6 pm.

GRK—7185kc, 41.75m. This one is heard in the Home service at 3 am and 6 pm.

GRM—7250kc, 41.38m. At one time this one was used in a transmission to Poland, but these days we think this one is serving as "Radio Oranje."

GRN—6194kc, 48.43m. Try for this at 5 am.

GRO—6180kc, 48.54m. Used in the African service at 3 am onwards.

GRP—17,890kc, 16.77m. This one was used some time back in the Eastern service, beamed to West Indies.

GRQ—18,030kc, 16.64m. This one is not heard these days.

GRR—6075km, 49.38m. A Home service station heard well at 2 am and 4 pm.

GRS—7065kc, 42.49m. This is still one of the best BBC stations at this location. Pacific service.

GRU—9450kc, 31.75m. Heard in the African service from 1.30 am till 2 am.

GRV—12,040kc, 24.92m. In Spanish for South America from 8.30 am till 12.45 pm. Fine signal.

GRW—6145kc, 48.82m. Another Home service station audible at 2 am and 4 pm.

GRX—9690kc, 30.96m. In the European service at 5 pm. News is read at 4 pm. Also heard at 6 am, giving news in the same service.

GRY—9600kc, 31.25m. Used in the African and North American services at 5 am and in the latter at from 6.45 am till 8.40 am.

The following readers have reported stations in the above group: Messrs. Perkins, Suffolk, Gaden, Swingle, Rhodes, Lee, Hanson, Churchers, Gillett.

INDIA AND ASIA

ABC—18,007kc, 16.56m, Batavia. This one is neard at various times throughout the day. Heard well at noon.

Voice of Batavia, 8846kc, 31.92m, same location. Can be heard closing at 2.30 am daily.

VUD2—6130kc, 48.94m, Delhi, India. A good signal from 11 pm to 2 am.

VUD2—7290kc, 41.15m, same location. This one is heard daily from 10.30 pm.

VUD4—11,830kc, 25.36m, same location. Also heard daily at 10.30 pm.

VUD3—15,290kc, 19.62m, same location. A good signal when news is read at 12.30 pm, and also at 3 pm.

VUD4—9590kc, 31.28m. An excellent signal in English at 9 pm.

VUM2—7270kc, 41.27m, Madras. Heard at 1.30 am. News is read at 1.50 am.

VUB2—7240kc, 41.44m, Bombay. This one is heard at 10.30 pm with an excellent signal.

VUC2—7210kc, 41.67m, Calcutta. This one also carries the same programme. Is also a very good signal.

VWY—9045kc, 33.17m, Kirkee, India. At 3.30 am is heard in service to Syria. Good signal.

XGOY—11,925kc, 25.14m, Chungking, China. Good signal from 6.30 pm to 11 pm.

XGOY—5950kc, 50.42m, same location. This one is heard from 10.30 pm to 12.15 am. News is read at midnight.

XGOY—9625kc, 31.17m, same location. News at midnight. Good signal.

XGOY—9635kc, 31.17m, same location. Heard irregularly on this frequency. Has been conducting tests so may be worth watching.

XGOA—9820kc, 30.86m, same location. Fair reception from 9.30 pm to midnight.

XGOI—9300kc, 32.26m, Shanghai. Is a weak signal these nights.

XGOI—9665kc, 31.04m, same location. This one radiates the same programme as the transmitter on 32.26m. This is the better signal.

XGOK—11,650kc, 25.75m, Canton. Operates irregularly but is fair when operating.

XGOX—15,200kc, 19.74m, Chungking. Can be heard at 7.30 pm reading the news.

XGRS—11,640kc, 25.77m, Shanghai. This German-owned station is heard nightly from 7 pm.

XPRA—9830kc, 30.51m, Kweiyang. A new one which is heard at from 9.30 pm.

XPSA—8465kc, 35.44m, same location. Heard in native type programme at both 6.30 am and 9.30 pm.

XGAP—10.270kc, 29.20m, Peking. Heard every night on opening at 11 pm.

XGAP—6100kc, 49.18m, same location. Heard well at 10.30 pm.

XLMA—9350kc, 32.09m, Shanghai. This must be one of the worst stations in the East as regards this location.

XMHA—11,855kc, 25.30m, same location. A very good signal at 8 pm, but is interfered with by DJB.

XIRS—11,890kc, 25.04m, same location. This one is Italian owned. Heard from 10 pm daily. Fair signal.

XGEI—16,092kc, 18.65m, Kuoming. Has not been reported for the past month.

FFZ—12,060kc, 24.88m, Shanghai. Heard from 8.45 pm, is still blanketed by Morse.

MTCY—11,775kc, 25.48m, Hsinking, Manchukuo. Still audible at 8 pm, when the band is good.

MTCY—9545kc, 31.43m, same location. Heard on occasions here at from 7 am until 8 am.

MTCY—6125kc, 48.98m, same location. Has not been reported for some time..

MTCY—5740kc, 52.28m, same location. This one radiates an English transmission at midnight to 1 am.

WHO'S WHO IN SHORT-WAVE BROADCASTING

ZRH Johannesburg, South Africa

Frequency: 6007kc. Wavelength: 49.95m.
Schedule: 2.30 am to 6.15 am.
Standard Time: 8 hours behind EST.
Distance from Sydney: 7800 miles.
Postal Address: PO Box 4559, Johannesburg, South Africa.
Identification Details: This station can be heard in company with the other stations in the South African network taking the BBC news at 6 am daily. The stations then close down with the National Anthem, which follows station announcements.
Verification Details: Replies with nice-looking card giving station details.

HI2G Cuidad, Trujillo, Dominican Republic

Frequency: 9295kc. Wavelength: 32.28m.
Schedule: 10.40 pm to 12.40 am, 3.40 am to 6.10 am, 7.40 am to 8.40 am.
Standard Time: 15 hours behind EST.
Distance from Sydney: 8500 miles.
Postal Address: HI2G, Cuidad, Trujillo, Dominican Republic, Central America.
Identification Details: Much broadcast music of the nature of waltz music and also broadcasts of a religious nature.
Verification Details: Replies after a delay with a nice card and station details.

LRX Buenos Aires, Argentina

Frequency: 9662kc. Wavelength: 31.06m.
Schedule: 7.30 am to 9.5 am, midnight to 1.15 am.
Standard Time: 14 hours behind EST.
Distance from Sydney: 7200 miles.
Postal Address: LRX, El Mundo, Benos Aires, Argentina.
Identification Details: This station relays the B/c station LRI, and frequently announces using this call. Frequent announcements are made in English. The native language is Spanish.
Verification Details: A nice card is sent in answer to correct reports, and in addition booklets are also sent.

SHORT WAVES

Saigon—11,780kc, 25.47m, Indo-China. As usual with good signal from 8.15 pm till 2 am. News at 8.15, 9.30 pm, and 12.15 am.
Saigon—6188kc, 48.48m. Heard from 10 pm to 2 am. This one is especially good in the Western States.
CR8AA—6250kc, 48.00m, Macao, Portuguese China. Can be heard at 11 pm, when conditions are good.
HSP5—11,715kc, 25.61m, Bangkok. The lady announcer makes nice remarks about us from 10 pm.
Voice of Thailand—7190kc, 41.72m, same location. Heard with fair signal, closing at 11.45 pm.
KZRC—6105kc, 49.14m, Cebu, Philippines. Has not been reported this month but is believed to be still operating.
KZRF—6140kc, 48.86m, Manila, PI. Under Jap control. Heard now and then.
KZRH—11,600kc, 25.86m, same location. "The voice of the new Philippines." Audible at 6.30 pm.
KZRH—9640kc, 31.12m, same location. Heard irregularly on opening at 10.30 pm.
KZRM—9570kc, 31.35m, same location. This one is not heard for some time.
EQB—6155kc, 47.74m, Teheran, Iran. An English session can be heard by the early bird at 4.45 am.
E??—8110kc, 36.99m, same location. This one also gives an English session at the same time. Followed by a transmission in French. Closes at 7 am.
XYZ—6007kc, 49.94m, Rangoon, Burma. Heard under Jap control from 10 pm to 11 pm.
ZHJ—6095kc, 49.21m, Penang. Heard using English at 10.30 pm. Fair signal.
JTHK—9964kc, 31.70m, Hongkong. This one has changed the wavelength; heard at 11 pm.
JZJ—11,500kc, 25.42m, Tokio, Japan. Heard with good signal on opening at 7 pm.
JVW—7257kc, 41.34m, same location. A very good signal at 6 am daily.
JIE2—9695kc, 30.95m, same location. Heard in English until 10.45 pm; lady announcer.
JLU4—17,795kc, 16.86m, same location. Heard at 11 am and at greater strength at 6 pm, giving news.
?—9390kc, 29.20m, same location. Used in transmission to India.
?—11,480kc, 26.13m, same location. Also used in the propaganda talks to India.
ZNR2—12,115kc, 24.76m, Aden. A good catch for the early morning riser. This one opens at 3.45 am.
Radio Levant—8030kc, 37.34m, Beruit, Syria. Is being heard well in New Zealand at 2.45 am.
Singapore—12,000kc, 25m, Singapore, SS. English transmission heard at 11 pm. Closes at 11.30 pm. Fair signal.
The following readers have reported stations in the above group: Messrs. Suffolk, Perkins, Swingle, Ferguson, Morris, Hanson, Gaden, Lee, Marsh, Hallett, Rhodes, Condon, Churchers, Gillett.

NORTH AMERICA

WGEA—6190kc, 48.47m, Schenectady, NY. This one is on schedule at 8.30 pm.
WGEA—9550kc, 31.41m, same location. Is on the air from 8 am till 3 pm. Can be heard well in the forenoon.
WGEA—15,330kc, 19.57m, same location. Heard at good strength in news at 12.15 am.
WGEO—9530kc, 31.48m, same location. Heard at 8 am to 3 pm, and also in transmission to this country from 8 pm to 11 pm.
WNBI—11,890kc, 25.23m, New York. This one is heard on Monday at 5 pm.
WNBI—15,150kc, 19.81m, same location. A good signal at 9 am. Also in relay with WBOS at midnight.
WNBI—17,784kc, 16.87m, same location. Is on the air at 9.15 am and at 11 pm.
WRCA—9670kc, 31.02m, same location. A very good signal at 4 pm. The programme is always worth listening to.
WCBX—15,270kc, 19.64m, same location. A good station in the forenoon. News in German and English is heard at 12.30 am.
WCBX—11,830kc, 25.36m, News is heard at 10.30 am. A good signal at 9 pm until closing at 9.45 pm.
WCDA—17,830kc, 16.80m, same location. News is heard in Spanish at 7 am. This transmission is heard until 9 am.
WLWO—15,250kc, 19.67m, Cincinnati, Ohio. News is heard at 5 pm. A good signal at midnight.
WLWO—11,710kc, 25.62m, same location. Can be picked up at 9 am.
WLWO—9590kc, 31.28m, same location. Heard at terrific strength on opening at 10 am.
WBOS—11,870kc, 25.27m, Boston, Mass. A good one from 8.30 am.
WBOS—15,210kc, 19.72m, same location. News is read at midnight. This transmission is to be heard from WRCA at same time.
WRUL—11,790kc, 25.45m, same location. On the air from 6.30 am to 8.30 am.
WRUW—9700kc, 30.93m, same location. Opens at good strength on opening at 6.50 am.
WRUW—11,730kc, 25.58m, same location. Another good signal at 9 am.
WRUW—15,350kc, 19.54m, same location. This one is very fine at 12.15 am on opening.
WCW—15,850kc, 18.90m, New York. The Voice of America. Has been heard at midnight. Also 7 am to 9 am.
WJQ—10,010kc, 29.97m, New York. Is heard quite well from 8 pm to midnight.
WDI—9700kc, 32.60m, same location. Is heard opening at 5.45 pm. News is read at 7 pm.
WDJ—7556kc, 39.70m, same location. Scheduled to be on the air from 4 pm till 5.30 pm.
WOK—10,555kc, 28.42m, same location. Is one of the old Telephone stations. Now being used from 9 am.
KWY—7184kc, 40.10m, Heard in point to point transmissions at irregular times.
KGEI—15,330kc, 19.57m, San Francisco. This one is heard from 10.30 am in some districts. Best reception at 1 pm to 2 pm.
KGEI—13,690kc, 21.91m, same location. This one is to be heard in the afternoon. Very good signal.
KGEI—7250kc, 41.38m, same location. Carries the same programme from 5 pm to 7 pm.
KEZ—10,400kc, 28.85m, same location. This is yet another of the KGEI group. Heard here at 7 pm.
KET—9480kc, 31.65m, same location. This one is very good from 7 pm daily.
KKQ—11,950kc, 25.11m, Bolinas. This one is heard in point to point commercial transmission.
KKZ—13,700kc, 21.00m, same location. Heard in the same programme at 2 pm on Sunday. Is worth listening to.
KJE9—10,750kc, 27.01m, Los Angeles. Is heard with good signal on opening at 1 am.
KRCA—9010kc, 33.29m, same location. Is used in point to point transmission at 4 pm.
KWID—15,290kc, 19.62m, San Francisco. This one is received at terrific volume in all parts of Australia. Schedule from 11 am to 5 pm.
KWID—9570kc, 31.35m, same location. Heard well daily from 5 pm till 11 pm.
CBFY—11,795kc, 25.54m, Montreal, Canada. Heard through the noise from 9.30 pm to 11 pm.
CFRX—6070kc, 49.42m, Toronto. Fair from 9 pm to 11 pm. Some times later.
CJCX—6020kc, 49.83m, Sydney, NS. Worth trying for at 10.40 pm.
CBRX—6160kc, 48.70m, Vancouver, BC. Opens at 12.30 am. News at 1 am. The signal fades out by 1.45 am.
VONH—5970kc, 50.25m, St. Johns, Newfoundland. Worth trying for any night. Opens at 10.30 pm.
XEXA—6170kc, 48.62m, Mexico City, Mexico. Heard on occasions at midnight.
XEWW—9503kc, 31.57m, same location. Is on the air from 2.30 pm to 4 p.m. In addition is also audible at midnight.
XEQQ—9680kc, 30.99m, same location. Heard from 2 pm to closing at 3.25 pm. This one is also on the air at midnight.
XEFT—9550kc, 31.40m, Vera Cruz. Heard in English at 4 pm.
The following readers have reported stations in the above group: Messrs. Suffolk, Perkins, Cushen, Elsom, Gaden, Swingle, Francis, Ferguson, Morris, Hanson, March, Hallett, Rhodes, Lee, Condon, Perrett, Churchers, Jones, Gillett, Shepard.

CENTRAL AMERICA AND WEST INDIES

HP5A—11,700kc, 25.64m, Panama City, Panama. A good station which is heard well at 8 am and 11 pm.
HP5G—11,780kc, 25.47m, same location. This one is also heard from 11 pm at good strength.
HP5J—9607kc, 31.23m, same location. Also good at 10 pm. This the weakest of the three.
HH3W—10,130kc, 29.62m, Port au Prince, Haiti. A good catch which can be heard with luck at 6 am.
HHBM—9660kc, 31.06m, same location. This one is very rarely reported.
HI2G—9295kc, 32.28m, Cuidad Trujillo, Dominican Republic. Opens at 7.15 am and is audible until 8 am.
TIEP—6692kc, 44.81m, San Jose Costa Rica. Can be heard from 9.45 pm.
TIEMC—11,900kc, 25.21m, same location. Fair signal from 10 pm to midnight.
TIPG—9620kc, 31.19m, same location. This one is heard in fair signal from 10 pm.
TILS—6165kc, 48.66m, same location. A Sunday afternoon station. Heard from 2 pm.
TI4NRH—9740kc, 30.80m, Heredia, Costa Rica. This is an old one which sends out a very nice card. Heard now at 2 pm to 3 pm Sunday. Heard in addition at 10 pm daily.
TGWA—9685kc, 30.98m, Guatemala City, Guatemala. Heard until 2 pm daily and till 4 pm on Sunday.
TGWA—15,170kc, 19.78m, same location. Heard on Monday morning at 7.30 am.
YNRS—8585kc, 34.95m, Managua, Nicaragua. Can be heard at 11 pm.
COBC—9695kc, 30.94m, Havana, Cuba. Heard well at 8 am and in good style at 3 pm.
COBC—9365kc, 32.05m, same location. This one is also heard at the same times with the same results.
COCQ—8850kc, 33.90m, same location. Heard at 7 am, 4 pm and at 10 pm. The latter is an exceptionally good signal.
COCO—8700kc, 34.40m, same location. This one is used in English transmission at 10 pm.
COCX—9270kc, 32.36m, same location. "El lava Casin" is heard at 8 am and at 11 pm.
COCW—6330kc, 47.39m, same location. Opens at 10 pm and is received very well.
COCH—9435kc, 31.80m, same location. These Cubans come in well. This one is heard at 8 am.
COCM—9830kc, 30.51m, same location. "Cadena Saurutos." Heard well at 10 pm daily.
COCY—9246kc, 32.43m, same location. We have had this one reported in the morning at 7 am.
COCY—11,745kc, 25.55m, same location. One of the best with us. Is easy at 2.30 pm till 3.45 pm daily in English.
COK—11,620kc, 25.93m, same location. A good one at 8 am and at 1.30 pm.
The following readers have reported stations in the above group: Messrs. Perkins, Cushen, Gaden, Swingle, Morris, Condon, Gillett.

SOUTH AMERICA

HCJB—12,460kc, 24.08m, Quito, Ecuador. This one has been heard regularly on Monday morning at 8.30 am.
HJCD—6160kc, 48.70m, Bogota, Colombia. Heard in NZ at 12.30 pm. Good signal at Mr. Cushen's location.
HJCF—6240kc, 48.07m, Bogota. This one is also heard in NZ, but at 11.30 pm.
HJCX—6018kc, 49.85m, same location. This one is heard here on opening at 10 pm.
HCQRX—5972kc, 50.23m, Quito, Ecuador. Heard opening at 9.45 pm and in addition at 8.30 am on Monday only.
CB960—9600kc, 31.25m, Santiago, Chile. A good signal at 3.15 pm on Sunday.
CB970—9735kc, 30.82m, Valparaiso, Chile. Can be heard at 9.30 pm daily.
CB1170—11,700kc, 25.64m, same location. This is fair at 2 pm and good on closing at 2.30 pm Is open later on Sunday.
CB1180—11,975kc, 25.05m, same location. Can be heard at 9.30 daily with fine signal
OAX4J—9340kc, 32.12m, Lima, Peru. This one is heard very well indeed. Is on the air at 7 am to 8 am, 2 pm, Sundays. There is also a transmission at 11 pm daily.
OAX4G—6190kc, 48.47m, same location. A further station to listen to on Sunday afternoon. The time is 2.30 pm
OAX5C—9540kc, 31.45m, same location. Listen to this one at 4 pm on Sunday afternoon.
CXA8—9640kc, 31.12m, Colonia, Uruguay. We hear this one at great strength at 4 pm on Sunday. Is also on the air daily at 6 am.
PSH—10,220kc, 29.35m, Rio de Janeiro, Brazil. The only time this is audible is on Saturday at 9 am.
PSF—14,690kc, 20.42m, same location. The same remarks apply to this one.
PRE8—6105kc, 49.14m, Fortazela. Can be heard at 7 am on opening with very good signal.
LSX—10,357kc, 28.98m, Buenos Aires, Argentine. This one is also heard on Saturday at 9 am.
LRX—9662kc, 31.06m, same location. This one is on the same schedule as LSX.
The following readers have reported stations in the above group: Messrs. Perkins, Cushen, Gaden, Gillett.

AFRICA

ZOY—6002kc, 49.98m, Accra, Gold Coast. This one has not been heard during the past month, but is still on the air at 5 am.
ZRK—6097kc, 49.20m, Capetown, SA. This one relays the BBC news at 6 am, then closes.
ZRH—6007kc, 49.95m, Johannesburg. The same schedule applies to this one also.
ZNB—5900kc, 50.85m, Mafeking. All these stations are on the same schedule.
ZRO—9755kc, 39.75m, Durban. This one is not heard with the same strength as the others, but can be recognised.
Bulawayo—3800kc, 79m, Bulawayo. This one can be heard at from 3 am to 3.30 am.
SUX—7865kc, 38.15m, Cairo, Egypt. An Arabic service can be heard at 6 am.
SUP2—6320kc, 47.47m, same location. Audible at 2.30 am till 3.30 am.
Radio Cairo—5980kc, 50.17m, same location. Can be heard at 6 am. Good signal.
Radio Addis Ababa—9625kc, 31.17m. This one closes with an anonuncement in English at 1 am daily.
Radio Tananarive—6063kc, 49.48m, Madagascar. This one is still to be heard at 12.30 am till 2 am.
CR7AA—6300kc, 49.71m, Luanda Angola, P. West Africa. The schedule is 7 am to 8 am, 11.30 am to 2 pm, and 7 pm to 11 pm.

CR7AB—3490kc, 85.92m, same location. Same schedule.
CR7BD—15,250kc, 19.66m, same location and same schedule.
CR7BE—9840kc, 30.49m, same location. Yet another one in the same group.
CR6RA—9470kc, 31.68m, same location. This one operates from 5.30 am till 7 am.
FZI—11,970kc, 25.06m, Brazzaville, French Equatorial Africa. This station is to be heard at 5 am and at 3.30 pm. Very good signal at both times.
OPM—10,140kc, 29.59m, Leopoldville, Belgian Congo. "Radio Congo Belge" is heard at 5 am till closing at 5.30 am.
VQ7LO—6060kc, 49.50m, Nairobi, Kenya. Is heard on schedule from 2.30 am to 4.45 am.
Nairobi—10.345kc, 29m, same location. This is a relay from the previous station.
TPZ—12,120kc, 24.75m, Algiers, Algeria. A good station to be heard easily at 7 am and 5.45 pm.
TPZ2—8960kc, 33.48m, same location. This one works in relay with TPZ.
CNR—8035kc, 37.34m, Rabat, Morocco. Heard at 6 am in French. This station is at fair strength at 7 am.
FGA—9410kc, 31.88m, Dakar, Senegal. Is heard well at 5.15 am daily.
The following readers have reported stations in the above group: Messrs. Perkins, Condon, Gillett.

AUSTRALIA AND OCEANIA

VLR—9580kc, 31.32m, Melbourne. National programme. 6.45 pm to 11.30 pm. Closes at 11 pm on Sunday.
VLR3—11,880kc, 25.25m. National programme. 12.30 pm to 6.15 pm daily. Opens 20 minutes later on Sunday.
VLR8—11,760kc, 25.51m. National programme. 6.30 am to 10.15 am daily. 6.45 am to 12.45 pm Sunday.
VLG2—9540kc, 31.45m, Melbourne. To Eastern States of N. America, 9.25 pm to 10.10 pm, To SE Asia, 12.15 am to 1 am. Dutch, French, and English.
VLG6—15,230kc, 19.69m. To Western USA, 2.25 pm to 3.10 pm. To Tahiti in French, 3.55 pm to 4.40 pm. To Great Britain, 4.55 pm to 5.25 pm, and to New Guinea (in Japanese), 6.15 pm to 6.30 pm.
VLG7—15,160kc, 19.79m. National programme to 6.30 to 8.10 am. Noon to 2 pm, and 7 pm to 7.18 pm.
VLQ—9615kc, 31.21m, Sydney. Used in transmission to New Caledonia at from 6.25 pm to 7.25 pm.
VLQ2—11,870kc, 25.27m. To Western States of USA at 1 am—1.45 am. To SE Asia at 8.40 pm to 9.15 pm.
VLQ4—7220kc, 41.55m. Used in overseas service in French transmission, closing at 7.20 pm.
VLQ6—9580kc, 31.31m. In transmission to Great Britain at from 4.55 pm to 5.25 pm.
VLW2—9665kc, 31.04m, Perth. To SE Asia at from 11.15 pm till 12.55 pm.
VLW3—11,830kc, 25.36m. National programme from 8.30 am.
FK8AA—6130kc, 48.94m, Noumea, New Caledonia. Heard rather weakly over the past few months. 5.30 pm till 6.25 pm.
The following readers have reported stations in the above group: Messrs. Perkins, Swingle, Morris, Hanson, Rhodes, Lee, Condon, Churchers, Jones.

MISCELLANEOUS

OIX1—6120kc, 49.02m, Lahti, Finland. A good signal at 1 am.
OIX2—9500kc, 31.58m, same location. This outlet is heard at 5.30 am.
OIX3—11,870kc, 25.47m, same location. Heard well at 1.30 pm in relay with OIX2.
HAT4—9119kc, 32.90m, Budapest, Hungary. This one is heard at 9.10 am. Fades out by 10 am.
Radio Suisse—11,820kc, 25.28m, Berne, Switzerland. Heard in news service on Tuesday and Saturday at 4.45 pm till 6.15 pm.
HER3—6165kc, 48.66m, Schwarzenberg. Good at 6 am until closing at 7 am.
HER5—11,860kc, 25.28m, same location. This one is used in transmission at 11 pm on Sunday.
HVJ—5972kc, 50.23m, Vatican City. News service to Great Britain from here at 5 am.
HVJ—6005kc, 49.96m, same location. Heard in relay with the one on 50.23m.
HVJ—11,750kc, 25.55m, same location. Still doing good work in POW service at 5 pm. Good signal.
CSW6—11,040kc, 27.17m, Lisbon, Portugal. Heard well at from 4 am till 7.30 am.
CSW7—9740kc, 30.80m same location. Opens with fine signal at 6.15 am and remains on the air until 8.30 am.
Radio Metropole—11,740kc, 25.26m, Announces in Ukranian. Can be heard from 1.15 am to 1.25 am.
Radio Caledonia—7010kc, 42.81m. Heard well at 6.45 am, using English.
Radio Mediterrania—7035kc, 42.66m, Valencia, Spain. Heard at 6 am with lady announcer. Relays Malaga at 6.30 am till 6.50 am. Good strength.
Santander—11,870kc, 25.27m. News in Spanish at 2.30 am, prior to closing at 2.45 am.
EAJ22—7140kc, 42.02m, Orveido Relays Malaga at 6.30 am to 6.50 am.
TAP—9465kc, 31.70m, Ankara, Turkey. Can be intercepted at 5 am.
TAQ—15,195kc, 19.74m, same location. Heard at 10.30 pm.
YUB—6100kc, 49.18m, Belgrade, Yugoslavia. This one is heard at 5.30 am, when it is a good signal.
SBP—11,705kc, 25.63m, Motala, Sweden. This is one of the best signals heard from this country. Heard at 11 pm.
SBU—9530kc, 31.46m, same location. This is also a good signal at 4 pm.
SBO—6065kc, 49.46m, same location. Heard at both 4 am and at 4.49 pm daily.
LKQ—11,735kc, 25.57m, Oslo, Norway. This one is to be heard at 3 pm.
PCJ—9590kc, 31.28m, Huizen, Holland. Can be heard when conditions are good at 7.50 pm.
PCJ2—15,220kc, 19.71m. News in English at 11.15 pm. Good at 12.30 am.
Paris—6200kc, 48.39m, France. Heard irregularly at 5.30 am.
Paris—9520kc, 31.50m, same location. Very good at 4.30 pm daily.
Paris—11,080kc, 25.25m, same location. Fair signal at 5.45 am.
Paris—11,845kc, 25.53m, same location. Still being heard at 8.30 am and at 5.45 pm to 7 pm.
Moscow—15,230kc, 19.70m, Russia. A good signal at from 9 am to 10 am.
Moscow—12,060kc, 24.88m. This one does a service at 10.45 pm in English.
Moscow—10,040kc, 29.88m. Also in English at 11.30 pm.
Moscow—7625kc, 39.21m. A good one to listen to at 7 am.
Khabarovsk—9566kc, 31.36m. Heard from 8.45 pm. News is read at 10 pm.
Kuibyshev—8047kc, 37.28m. News in English at 5.30 am, read by a lady announcer.
Kuibyshev—9520kc, 31.51m. Calls America for news commentary at 10 pm.
Kuibyshev—6115kc, 49.08m. This one is also in the same service as the previous one.
2RO3—9630kc, 31.15m, Rome, Italy Heard at 7 am and 3 pm.
2RO4—11,810kc, 25.40m, same location. This one is heard throughout the day.
2RO6—15,300kc, 19.61m, same location. Heard at 5 pm and at 10 pm.
2RO8—17,820kc, 16.84m, same location. Will be heard again soon.
2RO9—9670kc, 31.02m, same location. Heard at 2 pm on opening.
2RO11—7220kc, 41.55m, same location. This one opens at great strength at 4.40 am and is fine till 6 am.
2RO15—11,760kc, 25.51m, same location. Another one heard at 4 am.
2RO18—9760kc, 30.74m, same location. Heard well at 9 am.
2RO20—17,820kc, 16.87m. Operates with 2RO8 at 10 pm.
2RO?—10,330kc, 29.04m. This one is good at 7 am.
2RO?—6300kc, 47.60m. Very fine signal at 6.45 am.
IRW—19,590kc, 15.31m. This one will be heard again soon.
DJA—9560kc, 31.38m, Berlin. Can be heard at 3 pm and through the afternoon.
DJB—15,200kc, 19.74m, same location. At 9 am in service to the USA. Also heard at 1 pm and at 10.30 pm.
DJC—6020kc, 49.83m. Heard with fine signal at 6 am.
DJD—11,770kc. 25.49m. Very good at 9 am and at 5.15 am.
DJE—17,760kc, 16.89m. This one can still be heard well at 10 pm daily.
DJH—17,840kc, 16.81m. Can also be heard at 10 pm, but is also on the air at 5 pm.
DJL—15,100kc, 19.85m. News in English at 9.30 pm.
DJP—11,855kc, 25.31m. We hear this one at 6 am, 1 pm and at 10.30 pm.
DJQ—15,220kc, 19.63m. Heard at 3 pm and at 9 pm.
DJR—15,340kc, 19.56m. Opens at 3 pm and remains on the air until 2 am.
DJW—9650kc, 31.09m. Is on the air with DJA from 3 pm.
DJX—9670kc, 31.01m. Has not been reported for some time.
DXJ—7240kc, 41.44m. Heard at very fine strength at 3 am and at 6 am.
DXM—7279kc, 41.27m. Very good in the morning at 5.30 am.
DXP—6030kc, 49.73m. Another fine signal at 6 am.
DXR—11,760kc, 25.51m. Is on the air at 3 pm and at 9 pm.
DXX—6140kc, 48.66m. News in English at 5.30 am.
DXZ—9570kc, 31.35m. Transmission at 3.30 am in English.
DXL7—11,855kc, 25.30m. This one opens with DXC2 at 7.50 am.
DXL24—9620kc, 31.18m. Also in the 7.50 am hook-up.
DZA—10,087kc, 29.75m. A very fine one at 5.30 am.
DZB—10,040kc, 29.86m. Also good at 5.30 am.
DZD—10,530kc, 38.45m. This one is heard in English at 1 pm till 2 pm. Is also on the air at 5.30 am.
DZE—12,130kc, 24.73m. Very fine in the morning at 2 am.
DZG—15,360kc, 19.53m. Is not reported this month.
DXC2—11,740kc, 25.55m. Heard on opening at 7.50 am.
The following readers have reported stations in the above group: Messrs. Perkins, Cushen, Elsom, Suffolk, Gaden, Swingle, Harvey, Morris, Lee, Condon Hanson Perrett, Gillett.

A FEW FACTS ABOUT SPEAKERS

(Continued from Page 29)

the moving coil to the tube's plate circuit, serving also to keep any d-c out of the voice coil winding. This transformer has sufficient primary inductance and a suitable turns ratio to present an impedance value of about 400 cycles per second, which equals the required load impedance for the particular type of power tube.

When choosing a speaker, the type of power tube must be known; then we are able to look up this tube on the data sheets and find out the correct load impedance.

The load impedance for any particular tube is not always the same. With different operating conditions, the tube's plate load changes; therefore we should know the conditions under which the tube is operating when we are referring to the tube data sheets to determine the speaker transformer impedance.

The primary winding of the speaker transformer sometimes becomes open-circuited, and in this case it is necessary to replace the winding. This is a less expensive process than replacing the whole transformer. Replacement windings may be obtained separately from the iron core, in most cases, although with some of the modern types, which are enclosed n a metal case, and impregnated with wax, the whole transformer has to be replaced.

When ordering a replacement transformer or winding, one must make certain that the make and model of the speaker be given, also the desired primary impedance or, alternatively, the type of tube and, if possible, the conditions under which it is operating should be specified. If this is done, poor results due to the voice coil impedance or plate load impedance not matching will be avoided.

As there is sometimes a difference in the physical size of the transformers used on the same type of speakers, it is advisable to forward the defective windings, together with the information specified above, when ordering a replacement. This will obviate the possibility of the windings not fitting the iron core.

BRIGHTEN UP YOUR GARDEN — BUILD

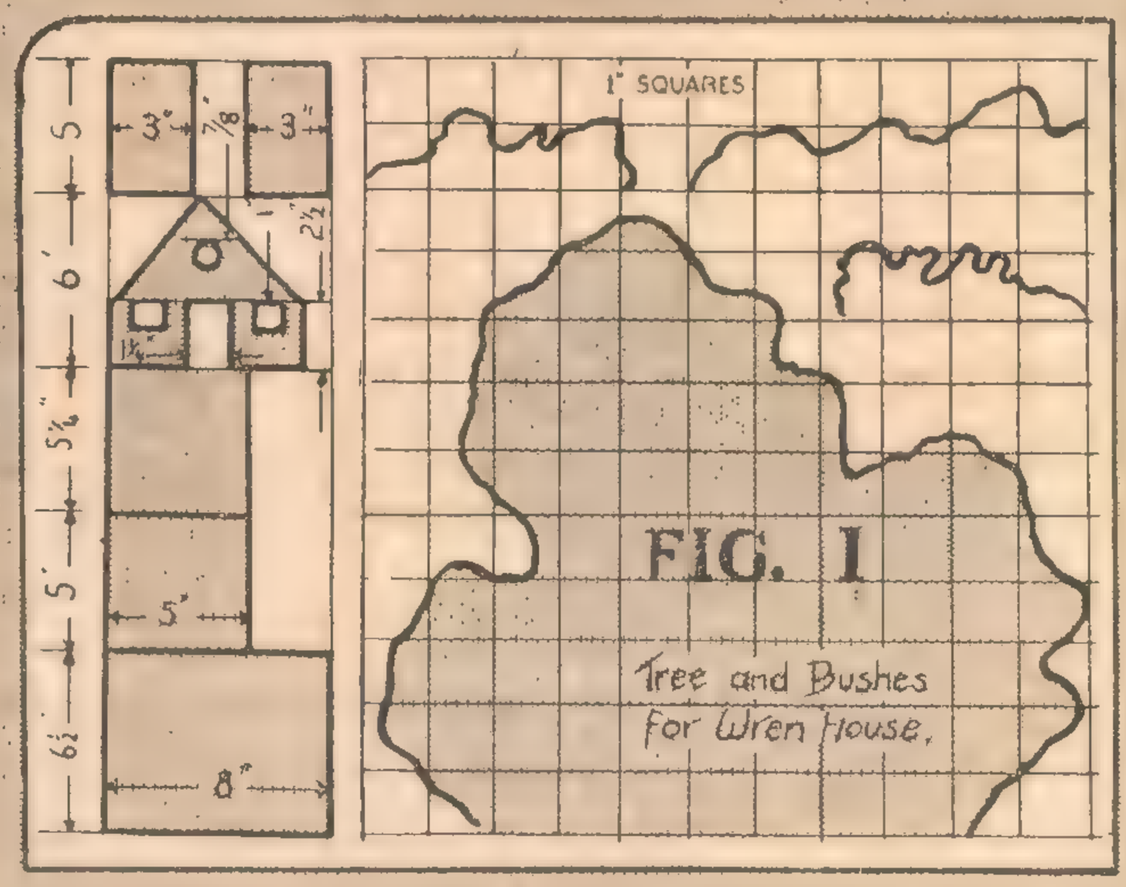
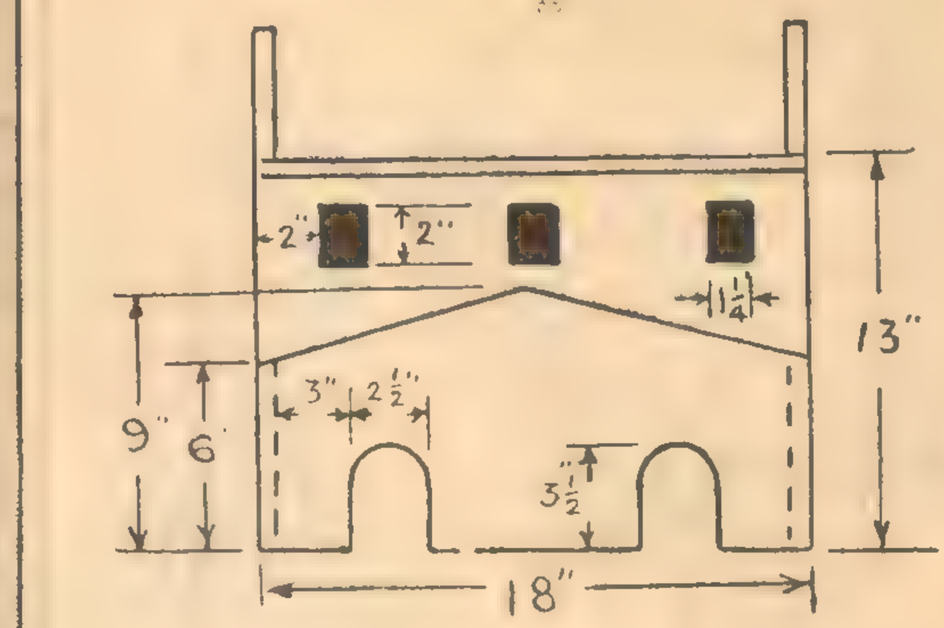


FIG. 1

Tree and Bushes for Wren House.



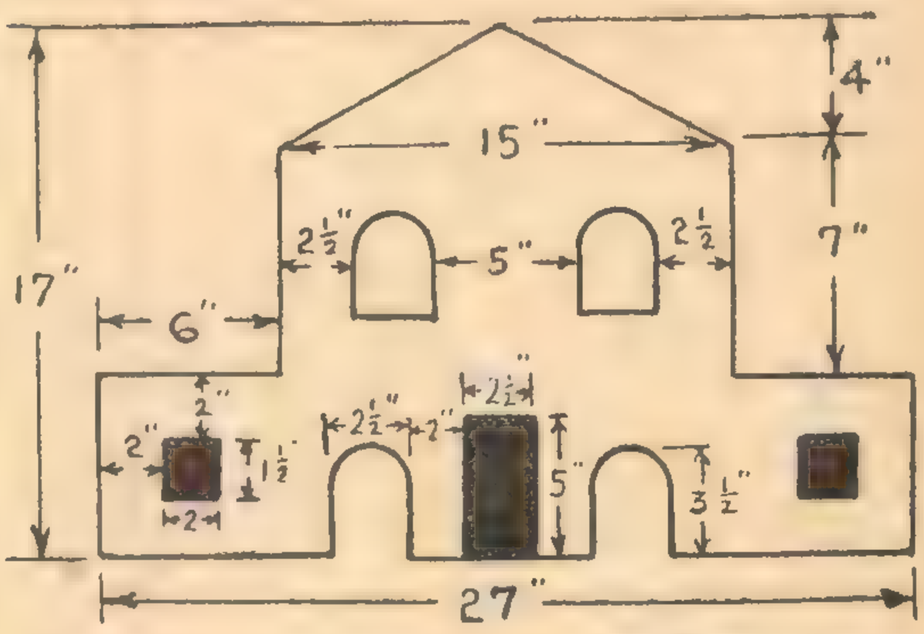
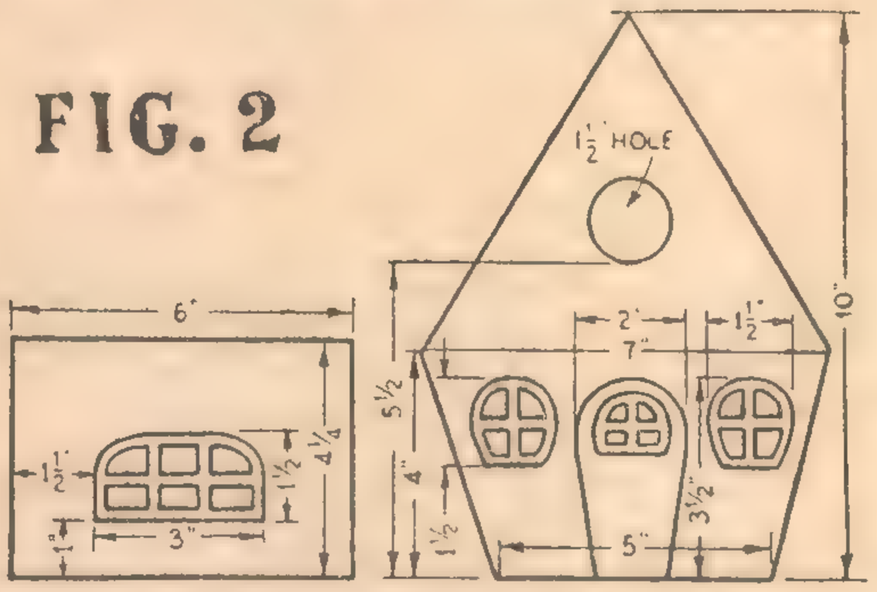


FIG. 3

FIG. 2



These simple little bird houses should appeal to those who wish to get on more intimate terms with our feathered friends. Besides being simple and inexpensive to build, they can be made very bright and attractive, and will add a spot of life and color to any garden.

QUARTER-INCH timber is used in their construction, preferably solid, although plywood can be used if the edges of the timber are thoroughly filled with paint to stop the ravages of the weather. Masonite and other materials of a like nature can also be used.

In Fig. 1 the dimensions are given for an extremely simple and pleasing model. The house itself is cut from a piece of material 28in. long and 8in. wide. The bottom piece of wood, measuring 8in. by 6½in. long, forms the base.

The large tree shown in the squared sketch forms the back of the house itself.

Where the various pieces go, and how it is assembled, is clearly seen in the photograph accompanying this article. The roof should be painted red, the walls buff, the door and windows brown, and the tree and bushes a bright green.

That in Fig. 2 is a little more decorative in design, but just as simple to build. Two side pieces are cut to the dimensions shown, 6in. by 4¼in. Also cut a back and front, which are identical, with the exception that the circular entrance hole is omitted from the back portion.

by
W. G. Nichols

The roof is made of two pieces of material 8in. wide by 7in. long, the inside of the top edges being chamfered to make a neat weatherproof join. If made to the above dimensions, the roof should overhang the house by about 1in.

The accompanying sketch will give a clear idea of how it is put together, and also a suggestion for mounting it and placing it in the garden. Again use gay colors in painting this model, painting the roof terra cotta and breaking it up into oblongs with thin lines of yellow paint to represent tiles.

THIRD TYPE

Fig. 3 shows a more elaborate type of bird house with a decidedly Spanish touch about the design and a more commodious interior. The back and front are cut out in exactly the same way, but the chimney is added to the front only.

Details of the various dimensions are clearly shown in Fig. 3, and a sketch of the finished house is also given to make the assembly an easy matter.

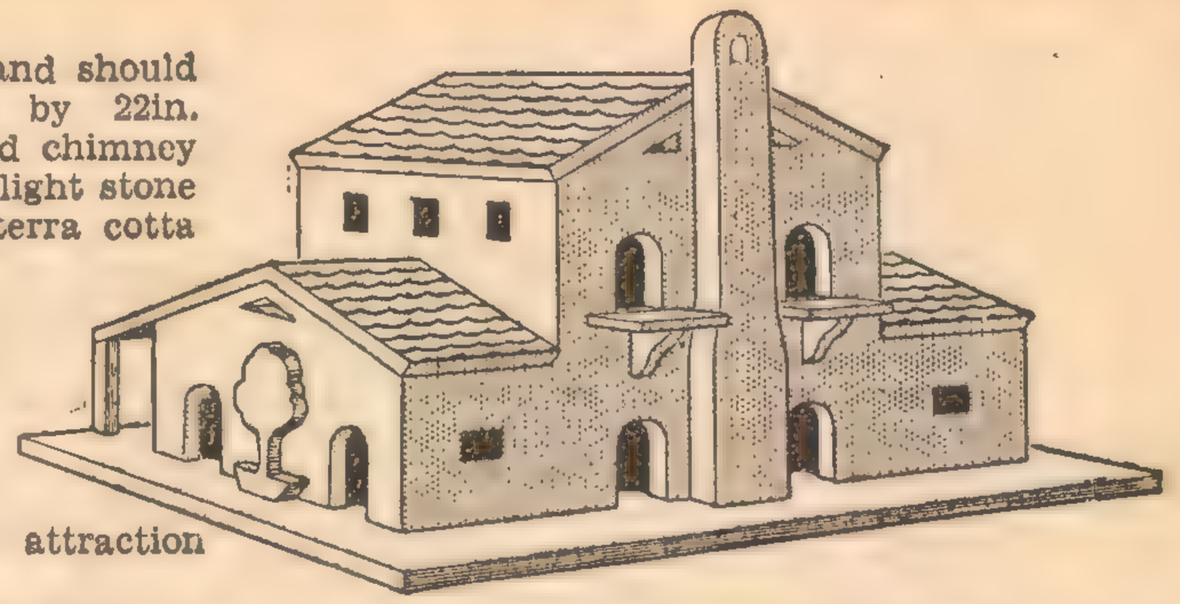
Small shelves have been added to the two upper windows in the front and back section to allow easy entry through these windows. Small trees in

ONE OF THESE COLORFUL BIRD HOUSES

If you follow the plans shown in figure 1, this is how the completed bird house will appear when assembled. It should, of course, be finished in bright colors.

from ¾in. material, and should be about 31in. long by 22in. wide. The walls and chimney should be painted a light stone color and the roof terra cotta with black wavy lines, as shown in the sketch, to represent tile roof. Small drinking and seed troughs placed on the base board will prove an added attraction to the birds.

With a little thought, a model of your own home, besides being an interesting project, will make a welcome refuge for the birds. In building a model, don't forget to sandpaper all the woodwork well before painting, as splinters left on window openings, &c., would prove most annoying to the inhabitants.



The bird house as shown in figure 3 is quite an elaborate affair and can be arranged to house a number of nests in separate rooms. It should be painted in accord with the Spanish style.

pots are cut out of scrap material and tacked to the walls to add interest, but for a more realistic effect, pieces of sponge rubber, cut to shape, painted green, and held in place by means of long, thin nails, may be substituted. However, scraps of wood serve the purpose quite well.

The base for this model should be cut

When you come to set up the bird houses in your garden, give the matter a little thought. They should naturally be mounted in a position where the birds can be seen, although they should not be so close to the house that the birds are continually being frightened by those passing in and out.

If you can choose a spot near a tree, so much the better. Face the entrance away from the prevailing winds and mount the bird house firmly so that it does not sway about.

Finally, keep it high enough to be away from the prying hands of little children. Birds don't mind a certain amount of company, but they have definite objections to people poking around in their nests when the mating season comes around.

A New Era In Rail Transport

(Continued from Page 27)

And something was. We're up here in the control cab of the Jeep, and the engineer is letting her down a steep grade. There isn't a brake on, but the heavy locomotive and her string of cars roll steadily downwards at 23 miles an hour.

She picks up a little on the steeper dips, and a light in front of the engineer flashes as the speed passes 25. The engineer steadies her down with a touch of the air, and then releases the brakes again.

THE DYNAMIC BRAKE

You look back, around the curves, and not a wheel is smoking. At the foot of the hill you lay your hand against a wheel—it's cool as a cucumber. And that never happened before on any train coming down a steep grade.

The secret is the dynamic brake. You set your speed at the top of a hill, flip a switch, and your motors become generators. The drag holds back the train. The dynamic brake has been in use since 1910, but in previous trolly operations the power generated going downhill was fed back into the line and used to haul an upcoming train. In Dieselectric operation the problem was to get rid of the power. This was done by turning it into heat and spilling it over the roof.

This irks Dilworth, because an engineer hates anything inefficient. On the Jeep's run from Chicago to the West Coast, she generated more than 5200 horsepower—and wasted it over the prairies and ranges. Some day someone will find a way to use that power—to refrigerate a fruit or meat train, possibly.

As the motor car industry slowly takes over the job of supplying motive power to railways, it is interesting to note the difference in methods. Each steam locomotive is something of a prima donna; railway companies build them in small batches, seldom more than 20 or 25 at a time.

Each company has its own ideas, and so one standard design cannot be used. The Dieselectric builders stick to one master design, as motor car builders do, and make only minor changes to meet the necessities of various tracks.

THIS IS A JEEP

If you want to build a Jeep, you first place 16 pairs of 40-inch wheels on a track. Then you put 16 electric motors above them, and gear the motors to the axles. Then you add four generators to make power and four 1350-horsepower Diesel motors to run the generators. You add an electrical system, air and water lines, controls, lights, brakes—and even toilet facilities.

Then you enclose the result in a steel box, put a control cab at each end, and cut the thing into four sections, so it will take sharp curves and make continuous running possible with even one or two motors out of service.

Then you will have a locomotive 193 feet long, about 10 feet wide and 14 feet high. Next time you walk past 15 motor cars, closely parked at the kerb, take another look at their length—that's the length of the Jeep. And it has about the same power as 60 average motor cars.

WHAT OF THE FUTURE?

The effect of the impact of war on the Dieselectric motive industry is not yet clear. Whether emphasis will be placed on increased production of locomotives to meet the ever-growing demands of American transportation of raw materials and completed products, or whether the complex system of machine tools will be broken up for manufacture of individual items of defensive production, remains to be seen.

In the meantime, the engineer, at the conclusion of his trip, leans back in his swivel chair, flicks a speck of dust from his suit, straightens his tie, and grins:

"Some engine, Brother!"

JOE'S COLUMN

LAST WEEKEND turned out to be quite interestin'. I had no particular plans so started huntin' around the house and workshop for any old rubber, so I could get it ready for the collectors. Rummagin' about the workshop started me off and I gave the place a good old clean-up. I put every tool back in its place, cleaned down the bench, got rid of all empty bottles and tins, and then swept the floor. Even the window and light globe were cleaned. When I had finished, the place certainly looked good. I always hate startin' to do a job with the bench untidy. If the bench is clear, I'll tackle any job.

After surveyin' my handiwork, I took a can of oil and oiled the vice, then the door hinges and the hinges of the tool cupboard. With the craze well on me then, I wandered outside, oiled up the front gate and the back gate, eliminatin' all squeaks and makin' sure that they closed themselves when left open by tradespeople.

This is an important point, because, if there are any small children playin' inside, they are sure to wander out into the street if a gate is left open and expose themselves unwittin'ly to danger. This is a case where a simple gate spring costin' a couple of shillin's could save a lot of grief.

I then went inside the house and oiled every hinge I could find, includin' the door of the refrigerator and the kitchen cupboards. Then I went to work and pulled down all the locks in the house. Each was cleaned and oiled and placed firmly back in position. It is surprisin' the number of people who have locks on their doors that are loose, stiff, or noisy, and suffer them for years without thinkin' of goin' to work on them with a screwdriver, oil can, and a will to improve their house.

While on the job, I checked the openin' and closin' of every door and made sure that none of them was stickin'. A door that sticks, even for only a short time when usin' it, is the cause of more annoyance than most people think. If you are in a hurry and have to have two or three goes at openin' the door, over a period of years it would amount to a lot of time wasted.

Then it was the window's turn. I oiled and silenced any that required it and made sure that the locks were easy to operate, and also were still held firmly on the window. A window that is operatin' correctly should move up and down at the slightest pressure and should stop in any position desired when the pressure is removed.

After the day was over I found that my series of little jobs added up to somethin' and that I had really enjoyed myself. Maybe you, too, could do the same some time—it'll improve your house and make it easier to live in.

Battery Operated S.W. Converters

(Continued from Page 41)

quires the use of a two-gang tuning condenser. Both coils have adjustable iron cores.

For purposes of alignment, a trimmer must be connected across each section of the tuning gang. These have to be fitted separately if they are not already on the gang condenser. Thus, in connection with the tuning circuits, there are four adjustments, two trimmers and two iron cores.

However, in return for the added complexity, the performance is rather better and double spotting is minimised, due to the selective aerial circuit. This point was referred to earlier in the article.

OUTPUT TRANSFORMER

The Crown kit also includes a tuned output transformer, with tappings for both high and low impedance aerial coils. This further aids the performance, again at the expense of simplicity.

The output transformer resembles an I-F transformer and has a single trimmer to adjust. As it stands, the trimmer will resonate the coil between the limits of about 1400 and 1600 kc/s. To resonate the coil at the low frequency end of the band, it is necessary to add a .00025 mfd. condenser in the position indicated in the circuit.

For the rest, the electrical circuit follows along the lines already discussed in connection with the RCS converter. The same precautions were taken to ensure the maximum oscillator grid current.

One point, not referred to earlier, was the negative bias applied to the control grid. The operation of the 1C7-G with zero bias is convenient, but does not make for the best results on short waves.

THE CHASSIS

As in the case of the a-c version, this particular converter was built up on the "Little General" chassis, with a view to housing it in the "Little General" cabinet. The chassis and cabinet with provision for two controls is preferable, although the three-hole variety may be pressed into service by adding a dummy knob.

The photographs and diagrams show clearly enough how the parts are arranged. The gang and dial mount in the intended positions. The coils are on small brackets across vacant holes, and the three terminals are ranged along the rear of the chassis. The positions of the valve and output transformer are clear. A four or five-pin battery socket could be mounted in one of the vacant valve holes.

The external connections for the Crown converter are the same as for the RCS converter, there being connections to the aerial, the A, B, and C batteries, and to the aerial and earth terminals of the main receiver. The latter should preferably be with a short length of shielded wire.

When the converter has been connected up and switched on, there are a number of adjustments to be made. We repeat, briefly the instructions given last month:

Set the receiver dial to the high or low frequency end of the B/C band, according to whether or not you have added the .00025 mfd. condenser to the output coil. Choose a setting for the B/C receiver dial clear of B/C stations.

Now rotate the converter dial until a signal is heard. Keeping the signal tuned in, adjust the output coil trimmer for best results. If the trimmer will not peak properly, try altering the setting of the B/C receiver dial slightly, or altering the capacitance of the shunt condenser, i.e., the .00025 mfd.

The next step is to adjust the tuning circuits of the converter. Set both trimmers to the middle of their range and the cores of the aerial and oscillator coil, so that they protrude respectively about $\frac{3}{8}$in. and $\frac{1}{2}$in. from the formers.

CORES AND TRIMMERS

Bring the converter condenser plates nearly into mesh and tune in a S/W signal. Vary the setting of the aerial coil core, being careful to keep the signal in tune by moving the dial. Leave the core set where the signals are loudest.

Now turn the condenser dial plates nearly out of mesh and tune in another signal. Keeping the signal tuned, try and peak the aerial trimmer. You may have to reset the oscillator trimmer to permit the aerial trimmer to peak.

If necessary, you may be able to extend the band coverage in the high frequency direction by unscrewing both aerial and oscillator trimmers and cores a corresponding amount, as long as they will still peak.

The general idea is to adjust the cores at the low frequency end of the band and the trimmers at the high frequency end. The core of the aerial coil should always be slightly further in than the core of the oscillator coil.

MATHS. PROBLEMS

(Continued from Page 31)

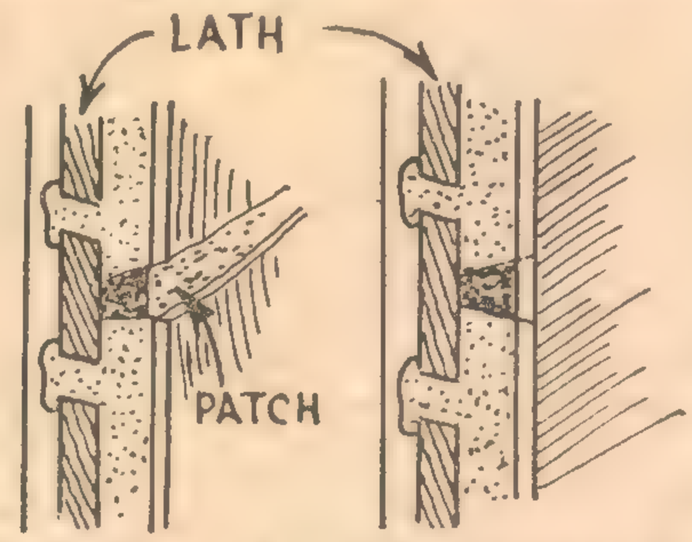
as in ordinary division, with one exception. That is, when you encounter the decimal point in the number to be divided, you must insert the decimal point in the answer. Thus 100.08 divided by 4 would be 25.02.

With regard to division by other than whole numbers, the simplest rule is to convert the decimals to whole numbers by multiplying both numbers by a multiple of 10. For instance, if we wished to divide 10.0662 by .42, multiply both sides by 100, in which case we obtain 1006.62 divided by 42. On working this out, you will find the answer equals 23.97.

USEFUL HINTS FOR THE HOME HANDYMAN

HANDY SOAP GRIPPER

Where floors are scrubbed by first rubbing soap over them, this removable handle will make it easy to hold the soap. Simply cut an oval piece of wood, drive six short, thick nails through it, and add a handle, as illustrated.

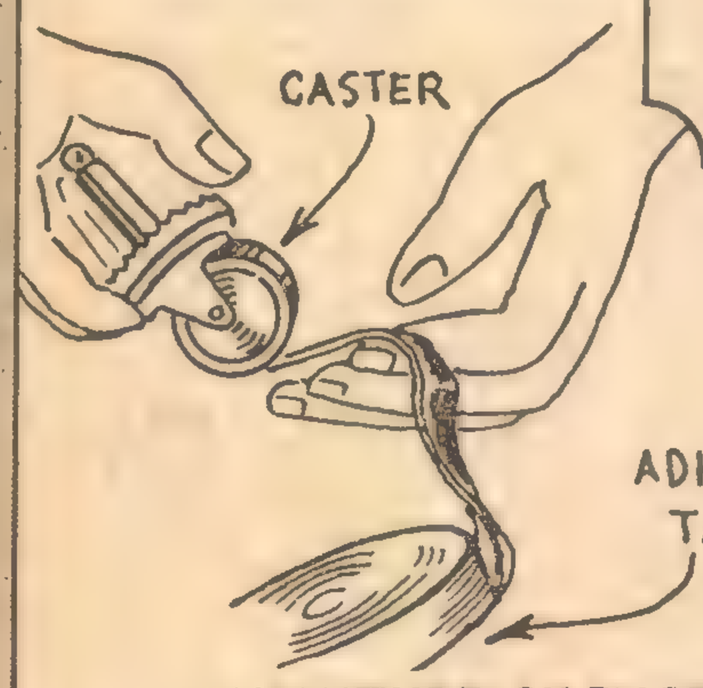


PATCHING CRACKED PLASTER

To obtain a professional and lasting repair to a cracked plaster wall, cut away plaster down to the lath, thoroughly wet side of crack and lath with water, and apply patching plaster, filling crack to about half its depth. Roughen new plaster, and allow to dry. Fill remainder of crack with thinner plaster.

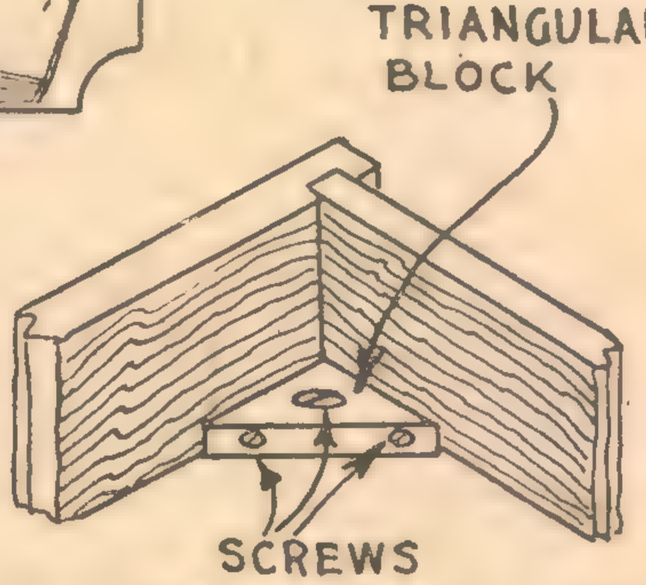
USEFUL MORTAR BOX

Easily constructed by cutting an old oil drum as shown by the straight dotetd lines in sketch, Drum is then bent back on uncut side, forming two sections, curved sides of which make it easy to scrape the mortar from one compartment to the other, as required.



FURNITURE SILENCER

Before shifting furniture around, wind two or three layers of adhesive tape around the castors. This will stop the noise from annoying people living below, and also save your floors from damage.



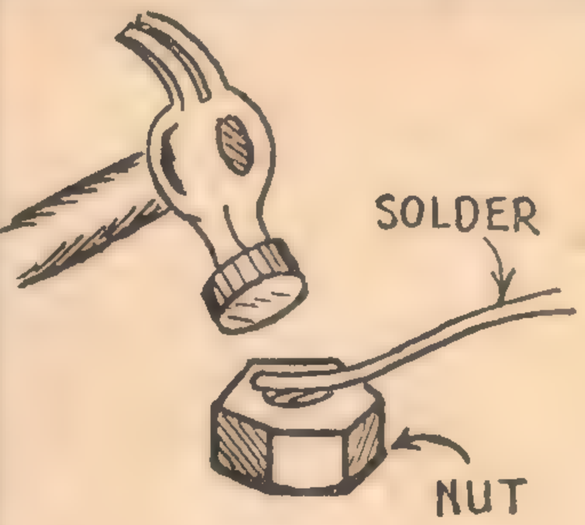
DRAWERS REPAIRED WITH TRIANGULAR BLOCK

Drawers often stick because the glue assembling rear section has loosened, allowing parts to spread. A small triangular block of wood screwed to bottom and sides of drawer will return it to original shape, and free sticking sections.

CONSTRUCTION

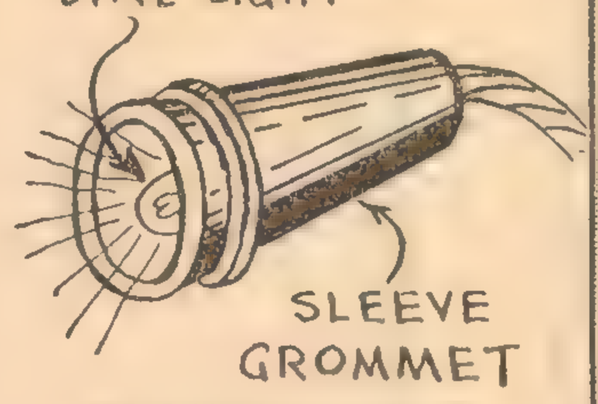
RADIO HINTS

By WALTER G. NICHOLLS



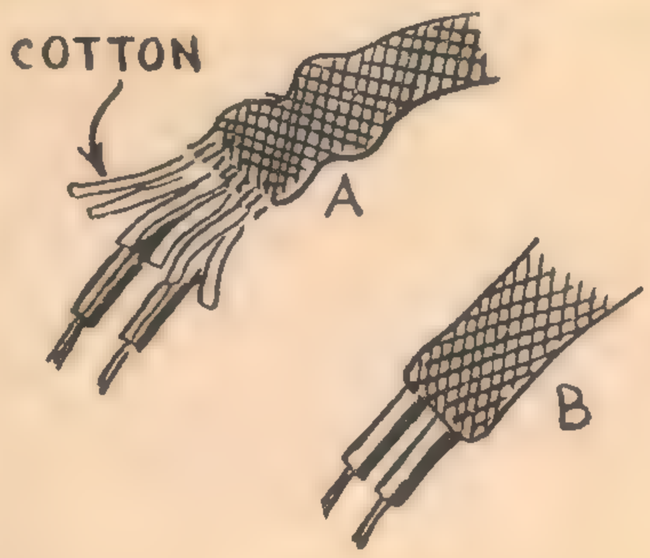
TEMPER SAVER

When faced with the problem of screwing a nut on in some inaccessable place, lay a piece of resin cored solder over the nut and give a sharp blow with a hammer. The solder spreads and grips the threads of the nut and, being pliable, can be bent to shape so that the nut can be easily handled.



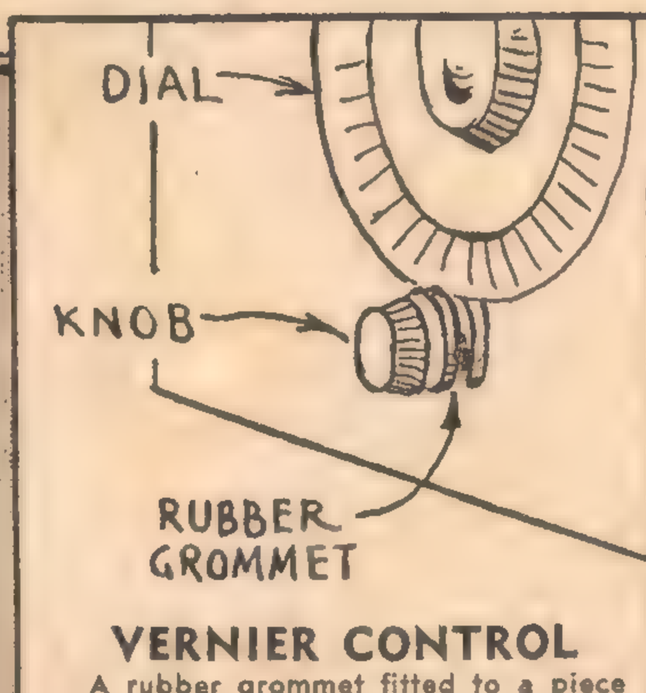
TROUBLE LIGHT

A handy trouble light is simply made by screwing a dial lamp into a holder, connected to a length of flex and then sliding the whole assembly into a rubber sleeve grommet. The grommet concentrates the beam and protects the lamp.



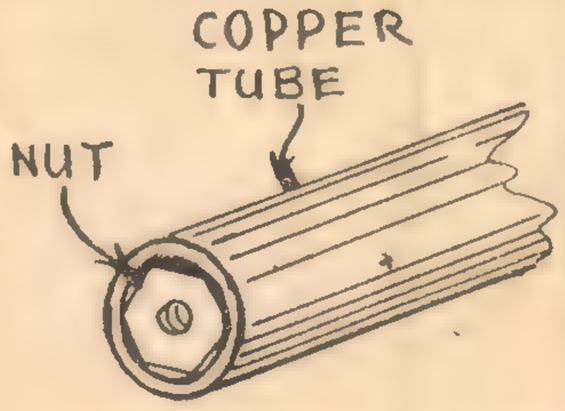
NEAT FINISH FOR FLEX

To give a neat finish to circular power flex, push back the outer braiding, cut off cotton packing, then slide the braid back into position, tucking the ragged end of the braid back under itself as shown in sketch (B).



VERNIER CONTROL

A rubber grommet fitted to a piece of quarter shaft and to the panel in such a position that the edge of the metal tuning dial rides firmly in the groove of the grommet makes a good vernier control. A knob should be fitted to the end of the shaft for easy turning.



HANDY BOX SPANNER

A handy box spanner can be made by taking a piece of copper or fibre tube and driving a nut into one end. The nut will cut a corresponding shape in the soft tube. To retrieve the nut simply screw a bolt into it and pull it out.

A FEW NOTES ON AC-DC RECEIVERS

(Continued from Page 43)

cuit was drawn out. The modern octal-based equivalents may be substituted without change to the electrical circuit.

The octal-based equivalent of the 6D6 is the 6U7-G. Other alternatives are the 78, 6K7, 6K7-G and 6K7-GT. For the 6A7 could be substituted the 6A8, 6A8-G or 6A8-GT. The 6J8-G could also be used as the converter, although it would be desirable to connect a 5000 ohm resistor in series with the oscillator anode supply, instead of the direct feed as shown for the 6A7.

For the 6B7S, the only equivalent is the 6G8-G. For the 6C6, the equivalents are 6J7-G and 77. For the 43, the octal-based equivalent is the 25A6-G. Possible substitutes for the 25Z5 are the 25Y5 and the 25Z6-G.

HIGH TENSION VOLTAGE

Operating on d-c mains, the maximum high tension voltage would be about 180 volts, and perhaps a little higher on a-c mains. The power output would be about 2.0 watts and the excitation for the field about 4.0 watts.

These figures are lower than in the usual a-c receiver, but are nevertheless ample for ordinary household use.

The circuit shows, as optional, a filter choke and filter condenser ahead of the field coil. The extra filtering is desirable, although not absolutely essential if you are not worried by a small amount of hum. For the choke, an 80 milliamp type is sufficient.

The connections are shown dotted for a tuning indicator. If the indicator is not used, the bias resistor for the output valve may be a single 450-ohm resistor.

Take note of the order in which the heaters are shown connected. Something was said in this connection earlier in the article.

SECOND CIRCUIT

The second circuit is reproduced from the RCA Manual, RC13. It is designed for operation from 110 volt mains, and is therefore not entirely suitable for local conditions. It may, however, prove useful to those of our readers on board ships equipped with 110 volt systems.

Space does not permit a lengthy discussion of the circuit, but we can at least quote the equivalents of the valve types specified:—

Converter: 6A8, 6A8-G, 6A8-GT, 6A7, 6J8-G (omit R3).

I-F Amplifier: 6K7, 6K7-G, 6K7-GT, 6U7-G, 6D6, 78.

Detector and Amplifier: 6B8, 6B8-G, 6B7.

Power Amplifier: 25L6, 25L6-G, 25L6-GT.

Rectifier: 25Z6, 25Z6-G, 25Z6-GT, 25Z5, 25Y5.

Note that the filter network is connected in series with the negative lead of the mains. A single choke is used in association with two large filter condensers. A two-section filter could be substituted, but it would be necessary to see that the dc resistance was kept as low as possible.

BROADCAST BAND DX

by Roy Hallett

s usual this month a number of very interesting reports have een received from our readers. The writer thanks sincerely ese DXers for taking the time and trouble to write such ports, which are greatly appreciated and are very helpful when compiling these notes.

recent issues we have men- oned two strangers on roximately 690 and 740kcs. se were thought to be New anders, but Mr. Young, of h Australia, tells us that are South Africans. The er noted that these stations e heard better in SA than in eastern States, and guessed may be South Africans;

e writer believes the stations to ietermaritzburg, 697kc. and Durban .

. Condon, also of SA, mentions the South African Broadcasting oration, is not verifying reception W stations these days—no doubt to present international situation— it may be worth while sending rts to these stations, which, I sug- be sent to the SABC at Johannes- . These two stations are not heard well in the East States.

. Suffolk, of SA, and Mr. Tinning), were the first to draw my at- ion to XGAP'S change of fre- cy. XGAP Peking, China, is now 50kc. (moving from 640kc) and is d now on this clear channel from nd 10.30 pm at my location with signal strength.

veral reporters reported last th a station on 1540kc., which an- ced a location sounding like Hono- Hawaii. Mr. Tinning again helps ut, by informing us that this is a station, in Waterloo, Iowa, USA. can easily see the similarity in unciation of these two names. This ion is audible at various localities nd 8.30 pm, fair strength. Call sign XEL (thanks to Mr. Cushen, NZ).

READERS' REPORTS

he writer would like to thank sin- ly the following, who have been ghtful enough to send along a re- for this month's issue.

. S. Condon, Laura, SA; R. Eady, nderra; D. Berndt, Maleny, Q.; T. Hooper, Wahroonga, NSW; E. Suf- , Summertown, SA; G. Rhodes, Can- ra, ACT; L. Gliddon, Upway, Vic.; Obey, Bronte, NSW; W. Ramsey, urn, NSW; E. Perrett, Marrickville, W; D. Spencer, Forest Range, SA; R. ncis, Erskineville, NSW; E. Tinning, w, Vic.

Quite a number of our readers have been hearing the various police transmitters, which operate just off the high frequency end of the normal broadcast band. Sydney police, call sign VKG, Melbourne VKC, have been logged, as well as Newcastle and Perth. The writer heard a station around this region of the dial one night recently announcing as "Adelaide Radio," and giving shipping information, location of various boats at sea, &c.

This was given in code, so I did not make much out of the information being broadcast. The NSW Ambulance Station, VJA3, has been logged by the writer, and a station, VKK, used by the electric light, and I think the fire brigade people.

A check has not been made by the writer on these stations' frequencies. They are heard just above 1600kc's, sending messages to police cars, ambulance cars, power line repair cars, &c.,

LISTEN FOR THESE STATIONS

THIS month, we present a summary of stations likely to be heard in Australia from overseas countries. A complete list of NZ stations appeared last month, so we shall not repeat the list this month.

ASIA

Try for these, late at night, till around 2am best period, midnight to 1.30 am.

XMHA, Shanghai, China, 600kc. Weak signal.

KZRH, Manila, P.I., 618kc. Closes midnight; weak.

XGAP, Peking, China, 650kc. Note slight change in frequency; now heard on clear channel from around 11 pm or earlier. Rebroadcast on SW, 10,270kc. 29.2m.

XOJC, Nankin, China, 660kc. Quite good recently around midnight.

XPRA, Kunming, China, 690kc. Good when 6WF, Perth, signs off at 12.30 am weeknights, midnight Sundays. Also heard around 5.0 am.

'ZOH, Colombo, Ceylon, 700kc. Heard around 1.30; poor.

VUV, Hyderabad, India, 730kc.

VUT, Trinchinopoly, India, 758kc.

HS7PJ, Bangkok Thailand, 825kc. Very strong at times. Rebroadcast on SW, 49.6 metres approx.

VUC, Calcutta, India, 810kc.

VUD, Delhi, India, 886kc.

XOJB, Shanghai, China, 900kc. Good at midnight, QRM'd by a strange station apparently on same channel, believed to be Japanese.

"Radio Saigon," Indo-China, 1000kc. Heard best in WA, also QRM'd by strange station on same channel.

VUW, Lucknow, India, 1022kc.

VUL, Lahore, India, 1086kc.

XGOP, in China, 1150kc. Good occasionally around midnight.

VUY, Dacca, India, 1167kc. Best of the Indians; news 1.50 am.

XGOA, Chungking, China, 1200kc. Rather poor around midnight, being rebroadcast on SW 9820kc, 30.86m; also heard around 5 am with better signal.

VUM, Madras, India, 1420kc. Weak signal.

FFZ, Shanghai, China, 1420kc. Not very strong.

NORTH AMERICA

Try for these between just after sunset and midnight:—

XEAW, Reynosa, Mexico, 1570kc. Fair studios, Dallas, Texas, USA, announces in English and Spanish.

KFBK, Sacramento, Calif., USA, 1530kc. Fair 10 pm.

KFBL, Waterloo, Iowa, USA, 1540kc. Fair 8.30 pm.

KOMA, Oklahoma City, Okla., USA, 1520kc.

KGA, Spokane, Wash., USA, 1510kc.

WOAI, San Antonio, Texas, 1200kc. Heard around 10 pm.

KNX, Los Angeles, Calif., 1070kc. QRM'd by 6WB, Katanning; audible around 10.30 pm.

KPO, San Francisco, Calif., USA, 680kc. Good sometimes, 11 pm.

MISCELLANEOUS

Pietermaritzburg, South Africa, 697kc. Heard around 5 am, best in S. Aust.

Durban, South Africa, 749kc. Also heard around 5 am; appears to be heard best by South Australians also.

KGU, Honolulu, Hawii, 750kc. Notice slight correction in frequency.

KGMB, Honolulu, 590kc. Both Hawaiians heard opening 1.30 am, good signal strength; KGMB sometimes heard around 7 pm weakly.

CORRECTIONS

The writer has recently learned the correct call sign of the Hongkong station; it is, thanks to Mr. L. J. Keast, of "Radio World," JQAK. Last month we quoted Invercargill's call sign as 2YZ; this should read 4YZ. According to announcements heard via short-waves, the call sign of the 618kc Manila station is KZRH, not KZRM, as at first suggested.

All DX reports should be addressed to Mr. Roy Hallett, 36 Baker-street, Enfield, NSW. Reports for the October issue should be posted to reach Mr. Hallett not later than Saturday, September 5, 1942.

ANSWERS TO CORRESPONDENT

UNDER THE PERSONAL SUPERVISION OF THE TECHNICAL EDITO

RADIO AND HOBBIES INFORMATION SERVICE

FOR the benefit of our many readers, we maintain two distinct information services.

The first of these, conducted on these pages, is open to all and is quite free. If you have a problem which is bothering you, write in to us and we will do our best to give you the answer in the next issue.

However, remember that our issues are on sale at the beginning of each month and that they go to press in the middle of the preceding month. Therefore it is wise to get your queries in during the first two weeks of each month.

For those who cannot wait until the end of the month for the answer, there is the "Shilling Query Service." If you send in your query, accompanied by a postal note for one shilling, we will answer your query by letter as quickly as possible. You will understand that, with reduced staff, such letters have to be attended to when the opportunity occurs.

Make your letters brief and to the point. If you can number your questions so much the better. Do not ask for special circuits or layouts, as these take too much time to prepare. Very simple circuits can generally be sent, but we must be the judge in this matter. If we cannot oblige, your money will be refunded.

Make your postal note payable to "Radio and Hobbies," and address your letters to the "Technical Editor, Radio and Hobbies, 60-70 Elizabeth-street, Sydney, NSW."

W.M. (Oakleigh) has built up a small receiver, which apparently distorts on low volume.

A.: Owing to the use of a grid-leak detector, a certain amount of distortion at low volumes is inevitable. Try the effect of reducing the voltage on the plate of the detector to 45 volts. Also, the back-bias resistor is too small. It should be about 1500 ohms for best results. We note that there is no r-f choke between the detector plate and the primary of the audio transformer. This may be an omission from the drawing. If it is not in the receiver, it would probably have to be added before the reaction would be effective at the lower plate voltage.

B.E. (Unanderra) has built up a one-valve receiver using the 19 valve. It refuses to oscillate.

A: With the .25 meg. resistor in the plate circuit of the detector, the plate voltage may be too low. Try reducing the plate load resistor to about 0.1 meg. If you were to use transformer coupling, it might be better still. Other measures would be to increase the turns on the reaction winding and to try the effect of reversing the connections. Moving the reaction winding closer to the grid winding might also help.

P.B. (Turramurra) has a small receiver which is unreliable in its operation, making peculiar noises and cutting out on occasions.

A.: It is hard to say just what may be the cause of the trouble. There may be a faulty connection somewhere in the circuit. Alternatively, the r-f choke may be failing, or the trouble may be in the valve. Try the effect of a smaller grid leak, say 1.0 meg. If you cannot find any faulty connections, the only thing to do is to try replacing the parts one by one—partirularly the r-f choke and the valve. If you can borrow another pair of earphones, do so, as your phones might be intermittent.

W.D. (Victoria Park) has a large commercial receiver, and is apparently keen to improve the performance. Even as it is, the receiver must be much better than the usual run of commercial receivers.

A.: We note your remarks in regard to the large American receivers, but this isn't the opportune time to discuss the rights and wrongs of tariff and other barriers. The substitution of 6L6-G valves for the 6V6-G's would probably increase the power output a little, but would not improve the sensitivity. The speaker fitted to your receiver would probably be up to the standard of the medium-priced twelve-inch speakers on the market. The next step would be to a speaker such as the Rola G-12 or the Amplion Diphonic Kit.

C.B. (Childers), following our advice, has developed into a regular radio fan, and has become a regular subscriber to "Radio and Hobbies."

A.: We are pleased to know that your commercial receiver is performing so well, and that the whole thing has ended so happily. Much of the credit for "Radio and Hobbies" must be given to Mr. John Moyle, who has been in the RAAF since December last. The destinies of the magazine are now in the hands of the Technical Editor, Mr. W. N. Williams.

D.S. (Mallanganee, NSW), is interested in short-wave listening, and asks one technical question.

A.: Your letter has been passed on to Mr. Ted Whiting, who looks after our short-wave pages. Local broadcast stations sometimes rebroadcast programmes from picked overseas S-W stations, such as the BBC and certain Americans. Rebroadcasting of S-W stations by other S-W stations would certainly be rare, although we would not say that it has never been or is never done. The term "A" battery is applied to the battery supplying the filaments of a battery receiver. The "B" batteries supply the plates and screens of the valves.

A.J.Z. (Armadale) asks a number of questions in regard to the Luxury amplifier.

A: Thanks, A.J.Z., for the kind remarks in regard to "R. and H." It would not be satisfactory to use the 450-volt transformer in the Luxury amplifier without modification to the circuit, as the high tension voltage would be far too high. It would be better to arrange the circuit along the lines of the earlier 13-watt amplifier, using a field as a filter in addition to a choke, and a 7500 ohm. bleed resistor. The field would need to be of 1000 ohms, resistance and capable of dissipating 20 watts. For the rectifier, use a 5U4-G or a 5V4-G with resistors of 125 ohms, in series with each plate lead. The first filter condenser would need to be a good one. Your present 7500 ohm. speaker could not be used as the high tension filter, although the field could take the place of the heavy bleed resistor mentioned earlier. Wen you come to add the tuner, it would be desirable to increase the value of the bleed resistor so as to maintain the overall current drain substantially constant.

L.F.W. (Drummoyne) suggests the use of two 80 mA. transformers in parallel to take the place of single heavier transformers, the latter being difficult to obtain.

A: The scheme would probably work out but it would be essential for the two tr formers to have identical voltage ratings for the windings to be correctly phased. ensure proper sharing of the load, use tr formers of identical manufacture. If des you could use two rectifiers, but this w not be necessary unless the load current too high for a single one.

M.B.C. (Wentworth Falls) has built an amplifier and is now anxious to a scratch filter. He wants information to the design of the necessary inducta

A: Sorry, but we simply haven't the to work it out for you. You will find necessary formula on page 148 of the "Ra tron Designers' Handbook." The terms have to be transposed to find "N." Al natively, why not try using the winding windings of an old audio transformer the iron core removed. These may offer resonated within the audio range with ordinary variable condenser. The best adj ment could be found by a listening test. a later date, we plan to publish an ar on the design of air-cored inductances.

R.M. (North Sydney) has some parts on h and wishes to build up a small dual-w receiver along the lines of the "Little Gener

A: You could follow the circuit of the D wave "Little General" fairly closely. The p tode portion of the 6F7 could be used as I-F amplifier; the triode grid could be as a diode plate, the triode plate be earthed. To use the 6K8-G in place of 6J8-G, you would need to increase the o lator anode feed resistor to 40,000 ohms reduce the series screen feed to 20,000 oh Of course, you could follow the circuit un the heading "More Gain for the 'Little Genera simply adding a dual-wave bracket in p of the broadcast coils. This latter certa has higher gain but has no AVC, which i disadvantage. Thanks for the encourag remarks.

Unobtainable in most places, but we ca supply new 2A3, 6L7G, 6L6G, 6P7G, KF3 CRC1, KL4P, 5Z3, 1C5G, 12A7, 25A6G, 2A 6SC7, 1G5G, 6F7 Valves, and dozens of othe types. Also Transformers, Condensers, Di Glasses, etc., both New and Used. Write t us to-day for anything in Radio. **Denham Radio Service, Queensland Premier Radi Distributors, Box 145, P.O., Maryborough Queensland.**

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SHORT-WAVE REPORTS

L. Walker (Applecross, WA): Thanks for e page of "Broadcaster." It is very in-resting. The log is also very good. Regards.

A. E. Moore (New Farm, Q.): We were very ad to hear from you again. Hope that the ouble is now non-existent. Several people ve written saying they are having dial ouble. Sounds like a disease.

V. Rochfort (Grenfell, NSW): We would like welcome you as a new reporter to our ges. You are the first to report on the transmission put out by WGEO. Write ain. Regards.

R. Smart (South Caulfield, Vic.): We have ted your log and the stations therein. Glad hear that the 16m. stations are still hold-g up in the southern State.

J. Ferguson (Lindfield, NSW): Glad to ar from you and to hear that you are tting good reception. The stations you ention are heard at very good strength ese days, and are very interesting. As gards the BBC, we suggest that you listen them on Thursday, when they give the formation you are interested in.

E. H. Suffolk (Summertown, SA): Thanks lot for your letter, and kindly accept our ologies for not answering by mail sooner. s regards the bandspread system you out-ne, we would be very interested to have e details you mention. We must do some-ing about it ourselves, as well as being e recipient of requests for such details om several others.

Dr. K. B. Gaden (Quilpie, Q.): Glad to et your letter. The handle is very much order. Thanks for the information you nd and for the message per Mr. Keast. est wishes.

A. O. Marsh (Belmore, NSW): Welcome to ur ranks. We are glad to hear from you nd to learn that in reality you are quite an ld-timer. We are always pleased to hear om any listener. Thanks for the kind emarks about the magazine. Regards.

R. Hallet (Enfield, NSW): Your letter very elcome. We had wondered what had hap-ened to you. We will write in regard to e other matter. We did hear a part of he Swiss transmission. Wonder why you ould not hear them? All the best.

G. Rhodes (Canberra, FCT): We hope that ou are able to get some more definite data n the low frequency stations, and would ke to hear from you as regards them. hanks for the log.

A. Lee (Newcastle, NSW): Sorry to hear hat you are still getting trouble with your ial. Your log is very handy. Will write ou as soon as we can find a bit of spare ime. Best wishes.

A. Condon (Laura, SA): We are sorry to ear that you have been laid up, but glad o hear that you are now recovered. We ad the same trouble some years ago, and e have never forgotten it. Thanks for the og and the other information. You will ee we have used it.

R. Francis (Erskineville, NSW): Your letter lso very welcome, and we hope that the ew receiver is now reposing in its correct osition and giving the results you have oped for. Regards.

A. Black (Rockdale, NSW): We are afraid hat we are unable to supply circuit diagrams f the type you mention, as this would take p too much of our time, which is scarce nough as it is. However, we suggest that ou contact our Technical Editor through our query service. Thanks for your letter, nd we are looking forward to getting a report from you.

R. Simpson (———): Very pleased to get your letter, and thanks very much for the sentiments expressed therein. We hope that the receiver is operating by this, and that we will get a report in the near future. Glad to see that you have received yet another "first." All the best.

W. Harvey (Dubbo, NSW): Your letter was forwarded to us and we would like to welcome you to the pages. We will deal with the Italian station in the body of our notes. The American was KGEI. Glad to hear you are getting such good results with your one-valve set.

A. Cushen (Invercargill, NZ): Glad to hear from you with such regularity. Thanks very much for the information on the stations, which you will note we have made use of. Regards.

J. W. Swingle (Hawthorne, Q.): Welcome to you also. Pleased to learn that the set is now operating to your satisfaction, and that you are getting such good results from it. Am sending reply by mail.

H. Perkins (Malanda, Q.): Glad to receive your ever welcome letter. The report is up to its usual high standard, and we have no doubt that with the new receiver we will see even better reports. You will soon notice the benefit of the RF stage. Best of luck. Will write again.

N. A. Hanson (Merrylands): We still think there is something wrong somewhere with your calibration on that band. The others are apparently 100 per cent. We will be very pleased to accept your invitation in the near future. Am writing as soon as we get a chance. Regards.

M. Morris (Merewether, NSW): Many thanks for the letter and enclosure. We are very interested in the schedule, but it is a pity they do not look a little ahead. The log is up to its usual standard. The organisation you quote is controlled by the body you name.

L. Elsom (West Perth, WA): Very glad to hear from you and to read your interesting letter. We will certainly make good use of the dope therein. We are writing to you in the near future. Best wishes.

R. M. Churchers (Devonport, Tas.): Your report to hand, and thanks for the information you send. You seem to be in a very good location. The stations you mention are of the Inland Pedal Service. Good work.

E. J. Perritt (Marrickville, NSW): The French station is as you state. It is located in Vichy. As regards WGEO, we find them to be very good from 8.30 pm. Regards.

N. A. Hanson (Merrylands, NSW): Your report to hand, even though it was a little late. Hope your receiver brightens up a bit. We are suffering from similar trouble. All the best.

S. Jones (Punchbowl, NSW): Will be glad to see you when you are in this district. Any time you are around.

R. G. Gillett (Dudley Park, SA): We would thank you for the very fine log you have turned in this month. Reception conditions are certainly good up there. Regards.

Broadcast DX

Dr. K. B. Gaden (Quil-ie, Q.): Very glad to get your letter, even though it was a little on the late side. However, we are glad to know that you still find a little time in which to pursue your hobby. We wish you luck on the Bc. bands. As regards the "handle," we will correct this immediately, a you will see in my letter.

J. B. Keenan (Randwick, NSW): Welcome to our pages. We are very interested in your account of reception on the lower frequencies. Since your letter was too late for the inclusion of any great amount of your information in this issue, we will refer to the subject in full in the next issue. Regards.

L. J. Keast (Carlingford, NSW): Thanks a lot for the letter and the dope on the new stations. We are writing to you as soon as we get a spare moment. Best wishes.

D. Berndt (Maleny, Q): Many thanks for your excellent reports o.m.; they are always welcome, and you seem to have plenty of good things to report. I hope to mention the "cops" around 1600kc. in this month's issue.

R. Eady, Unanderra: Very pleased to receive that note from you, Bob. Glad you got 1YA's card. The NZers are free from QRM from Australian stations when they come in prior to sunrise. I, too, hope we may be allotted more space, as the paper rationing improves. Good DX!

A. S. Condon (Laura, SA): Your name is quite a familiar one to me, having seen it so often in various radio journals. Glad to know my guess re the two strangers being South Africans proved correct. You certainly have a good batch of stations in your log; thanks for details concerning them.

T. L. Hooper (Wahroonga, NSW): Thanks so much for your very welcome note. You certainly have a splendid array of aerials. I wish I had a little more space in my back-yard. Hope you have received your card from 2YA by now.

G. Rhodes (Canberra, FCT): Thanks a lot for your report. KGU puts in a good signal here, too, at times. Shall drop you a note and do my best to clear up the two mysteries. Good DX.

E. Suffolk (Summertown, SA): Many thanks for your "short" note, Ern. Sorry you did not get a report on those South Africans. Glad you got your letter of verification from KSTP. Yes, I have been fooled several times by those crazy harmonics. 73's.

H. Iffla (Narrikup, WA): Hope you have received a few Aussie QSL's. Yes, as far as I know, WCKY will verify; glad you have logged it. Mr. Whiting had something to say about the medium wave bands in the July issue.

E. Tinning (Kew, Vic.): Very many thanks for that fine report. Sorry, indeed, Ted, that you missed 6KY. Gosh, if only I had posted that letter! I cannot log South Africans, either. Good DX and 73's.

D. Spencer (Forest Range, SA): You always seem to have plenty to report each time you write. Good work! Hope you get your verie from CPFL. Thanks for the dope on the 1540kc. mystery. Glad you managed to log it.

E. J. Perrett (Marrickville, NSW): Glad you found the dope about the aerials of interest. Yes, that loop antenna seems to be a pretty good system for broadcast band work. KWID is terrific at night now, isn't it?

R. Francis (Erskineville, NSW): You certainly have a swell collection of Australian veries during the short space of time you have been chasing them. Good work. I feel pretty sure that it will not be long before you are reporting overseas stations.

W. Ramsey (Auburn, NSW): It is certainly strange how various localities affect reception of certain stations. Glad you have your aerial in operation now. I hope you have plenty of luck this season with the midnight Americans on the lower frequencies, when they come on in a few months' time.

G. Obey (Bronte, NSW): Glad you have your verie back from KGA. Good work. Strange that KNX is still being heard, while the other Yanks, KSL &c., have disappeared, but we'll soon have them back with us again. KFBK is only Yank heard here at present.

L. Gliddon (Upway, Vic.): Glad to know that you have got on to some Aussies. I hope you find the Q and R signals and list of Aussies of use. So very glad you think this page, and "R. & H." in general, is so interesting.

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READERS who wish to buy, sell or exchange goods are invited to insert an advertisement in these columns of Radio and Hobbies. The cost of such advertisement is 9d per line for a minimum of three lines, making the minimum charge 2s 3d. As regards space, it is reasonable to count seven words or letter groups per line.

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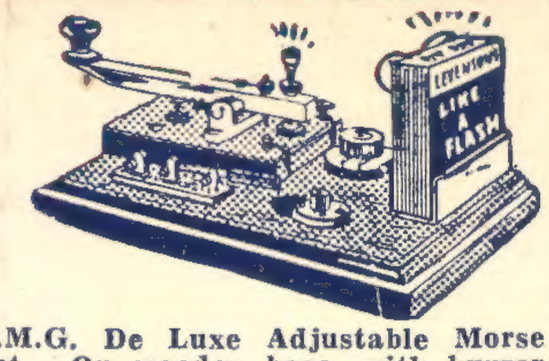

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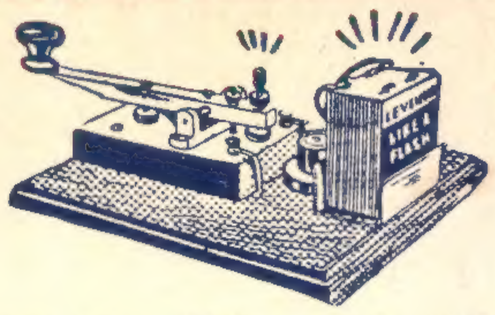

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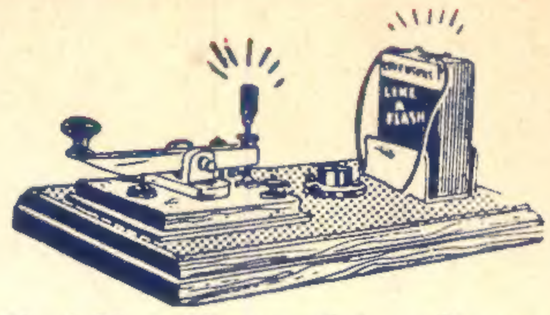

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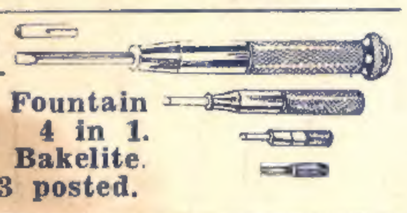

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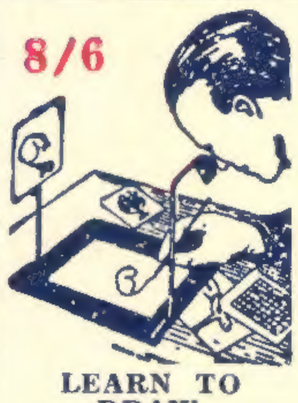

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59/6

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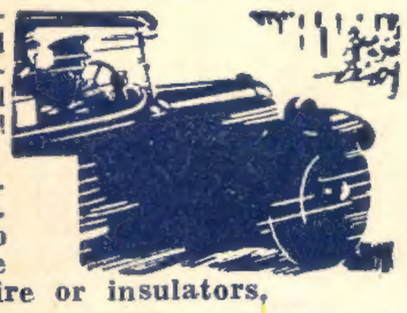
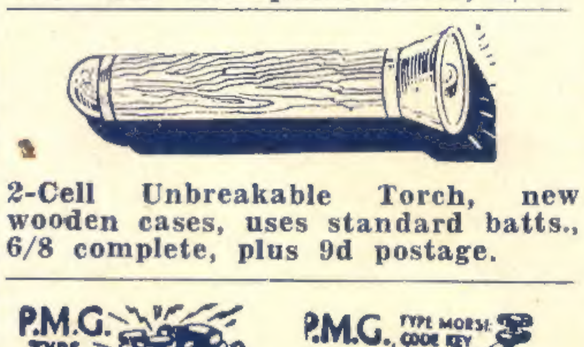


Multi-strand Rubber-covered Aerial Wires. 50ft., 3/3. 100ft., 6/6. Needs no separate lead-in wire or insulators.

FIXED CRYSTAL DETECTOR

Fixed Crystal Detectors with mounting clips, 3/6, 4/6.

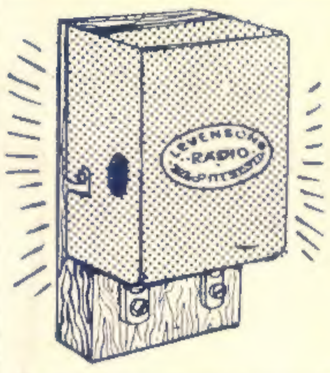
Junior Type Morse Code Keys, 7/11. Or Mounted on baseboard with battery and buzzer, 15/-.



2-Cell Unbreakable Torch, new wooden cases, uses standard batts., 6/8 complete, plus 9d postage.

35/

19/6



Adjustable Metal Case Buzzer, 4/3. De Luxe Type Buzzer, 11/3. Buzzers for Doors, Offices, etc., 3/6.

Morse Code Signalling Cards, 1/6 set. The Semaphore Tutor, 2/-.

3/6

Trick Pack of Cards, with full, simple instructions, 4/- posted.

Lightning Arresters, Bakelite, Bell Type, for in or outdoor use, 6/-.

2/-
OR
2/6
POSTED.

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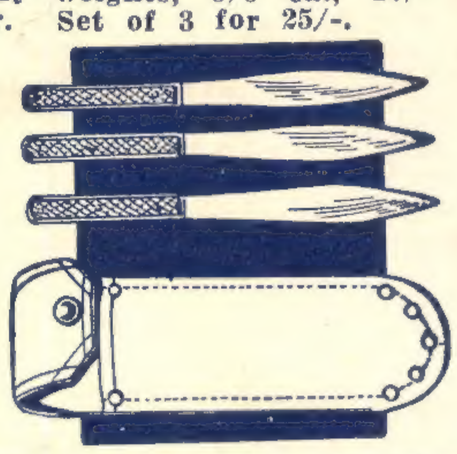
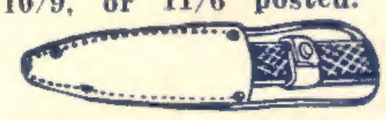
THE "RE-JUV" PATENT SAFETY RAZOR BLADE SHARPENER.

BALANCED Sheffield THROWING KNIVES. Overall length, 5¾in. Light weights, 8/6 ea., 17/- per pair. Set of 3 for 25/-.



Balanced Sheffield Throwing Knives. Overall length 7¼in. All in leather sheaths. 10/9, or 11/6 posted.

10/9



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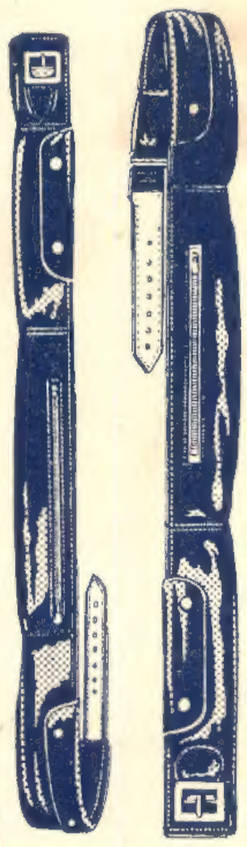
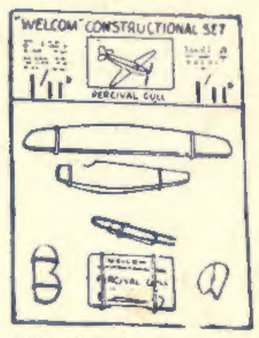
Electric Soldering Irons.

75 watt 13/6
90 watt 18/-
125 watt 26/3

Heavy Duty, 150 watt 46/6
12 Months' Guarantee.



Adjustable Calf Money Belts. Blue or Natural Polished finish. 10/6 posted.



"Skybirds" Solid Model Plane Construction Kits. Everything wanted included. Strong and Easy to build. Scale model, 3/6 each. Four models: Spitfire, Defiant, Hurricane. Messerschmitt. 4/- post.

Just Arrived! The Handbook for Wireless Operators, 1/6. Rubber Headphone Pads, 2/6 pair, 2/9 posted.

2/6 Pair

Surprise Match Box, 2/6. It jumps into the air. Surprise Rat, 3/6. Mice, 2/6. Add 4d extra each for postage.

Junior Morse Code Key, 7/11. Adjustable all ways, fitted with Buzzer and Battery ready for use. 15/-.

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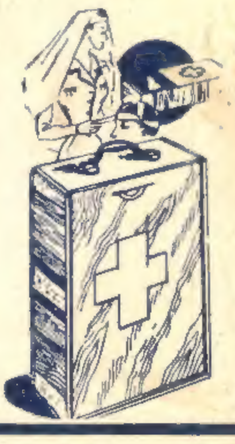

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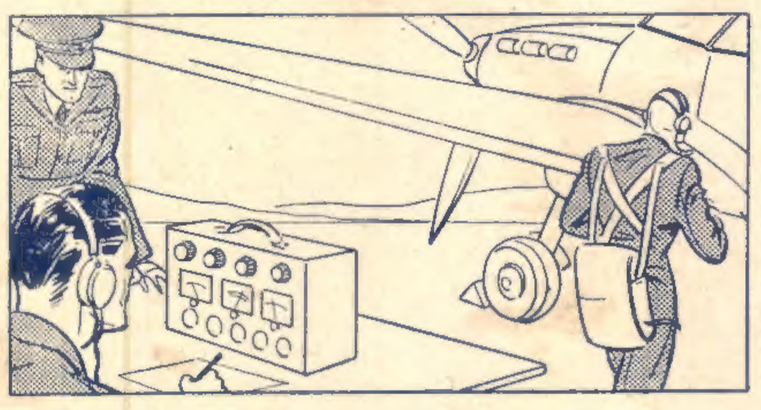
Until he heard about A.R.C. Radio Engineering training, and wrote for details of the course. He quickly saw the advantages of learning Radio Engineering, and started the A.R.C. course in his spare time.

John quickly learned enough to take a position at Radio Defence work, which was found for him by the College. This meant more money and good opportunities for advancement.

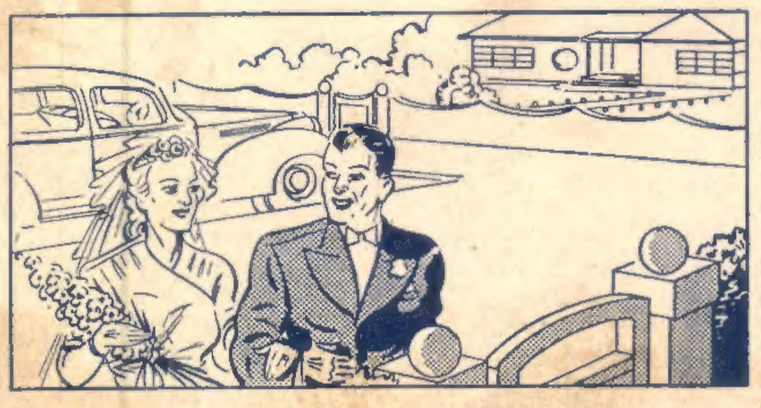
Had he wished at that time, he could have joined a Radio Unit in the Army at communications work, radio maintenance, or some other form of military radio work.



Or in the R.A.A.F. as a Radio Operator in air crew, or on the ground staff. Radio maintenance work, and radio location work, were also open to him.

Still on Defence Work, he carries on with his spare-time Radio training with the Australian Radio College. All the time making himself more and more proficient at Radio work

Soon, by reason of his training, he is promoted to take charge of his section of work. This means another rise and prospects of even more promotion.



This extra money means wedding bells for John, and a home of his own. He can see the fulfilment of his highest ambitions quickly taking shape.

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